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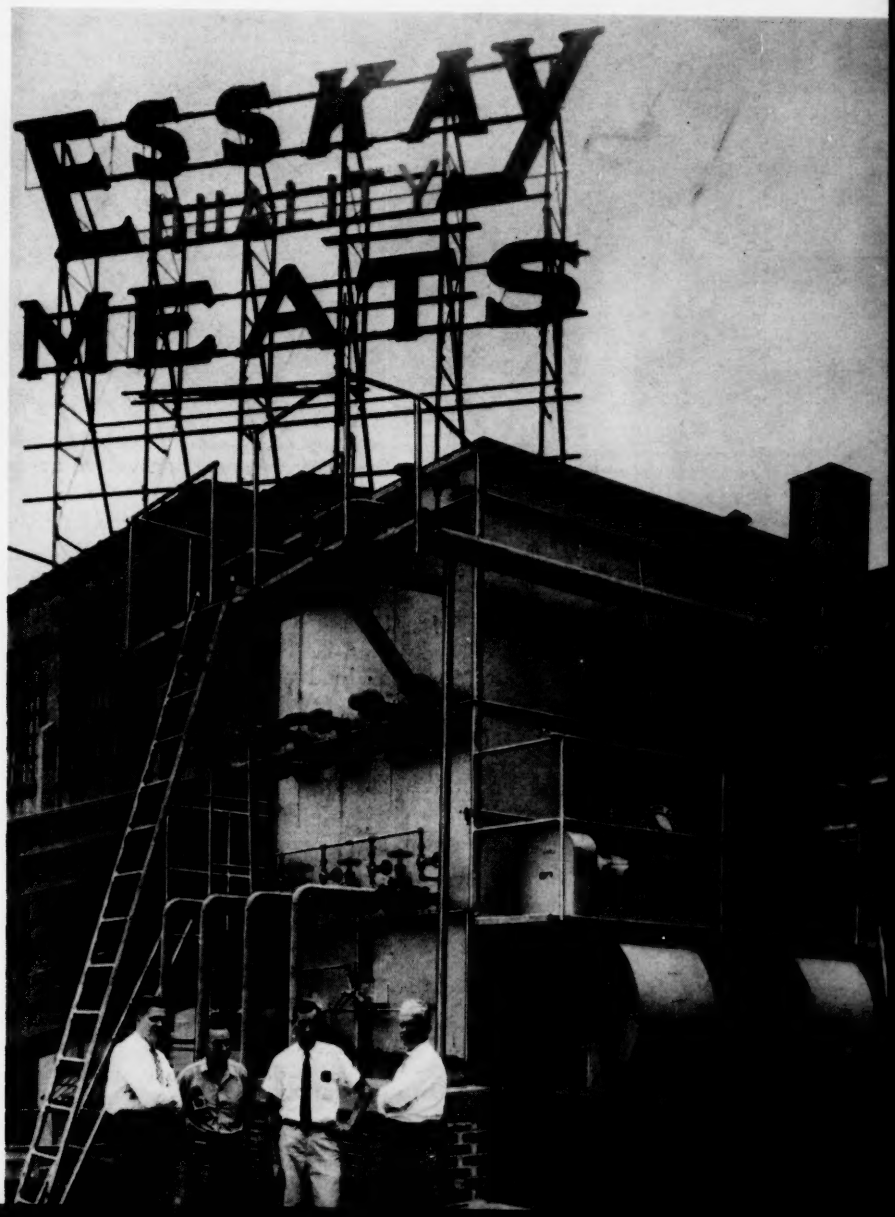
Serving the Industrial Refrigeration and Air Conditioning Industry

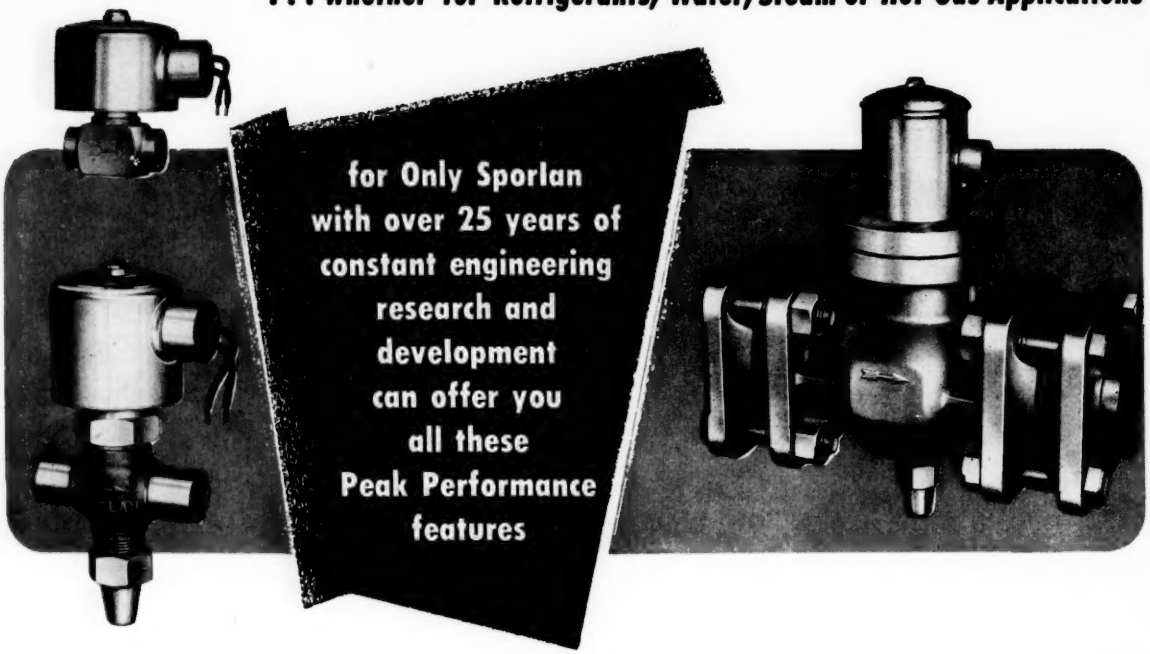


Cover – ESSKAY Stops Huge Monthly Water Bill With An Evap-Condenser

. . . don't accept anything less than

SPORLAN Peak Performance SOLENOID VALVES for any Installation . . . *regardless of capacity*

. . . whether for Refrigerants, Water, Steam or Hot Gas Applications



Sturdy take apart construction, few parts, all precision machined to assure positive closing.

All large capacity pilot piston operated Sporlan solenoid valves are equally applicable to Refrigerants 12, 22, and 500.

Sweat type connection valves assembled hand tight, saves valuable time in removing internal parts before installation.

Sporlan introduced synthetic seating over ten years ago to eliminate the possibility of seat leaks.

The famous Sporlan Blue Seal Coils with their high MOPD ratings permit the use of most valves for either Refrigerant 12 or 22.

Just three sizes of Blue Seal Coils fit the complete line of Sporlan solenoid valves.

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Since 1885

No. 51 AUTOMATIC ELECTRIC DOOR DEFROSTER

(WITH THERMOSTAT)

ELIMINATE ICING GASKET CONDITIONS ON YOUR FREEZER DOORS WITH BUTCHER BOY No. 51 AUTOMATIC ELECTRIC DEFROSTERS INSTALLED IN NEW FRAME CASINGS.

Easy to Install

ON YOUR PRESENT DOORS

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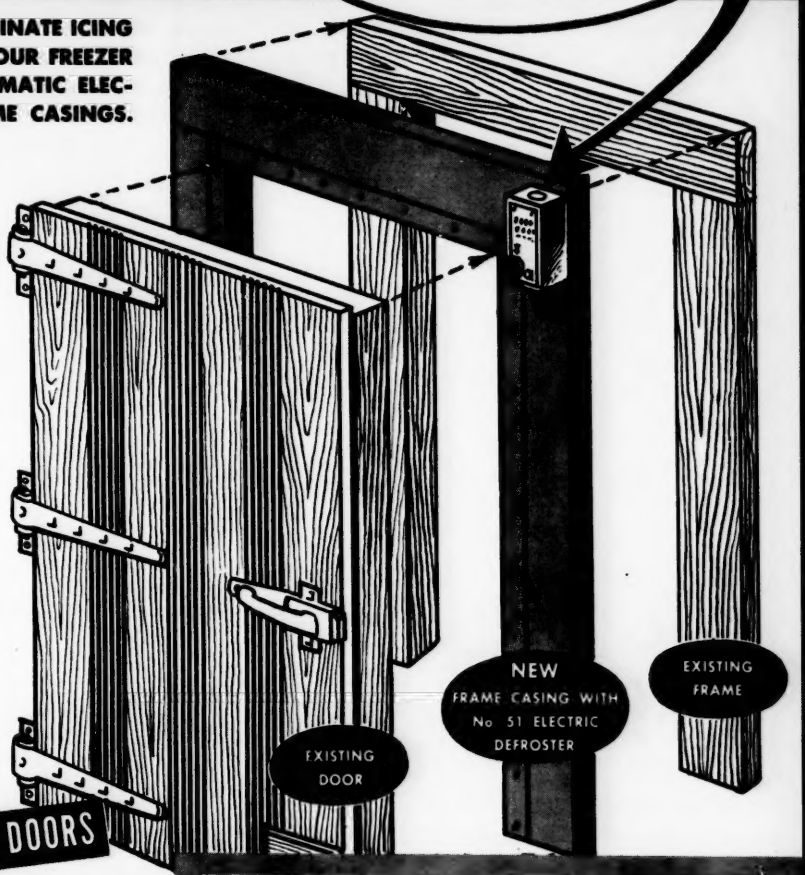
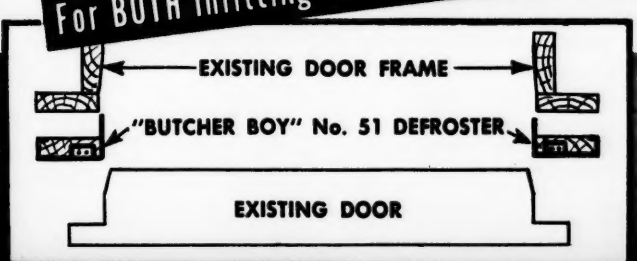


For BOTH Infitting and Overlap DOORS



Butcher Boy Refrigerator Door Co.
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Please send details and prices for factory furnished frame casings with No. 51 automatic electric defrosters.

For Super Freezer Overlap Doors ☐ _____wide x _____high

For Infitting Freezer Doors ☐ _____wide x _____high

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Seaboard Industries, 195 Keen St.

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PENNSYLVANIA
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Nashville: Cumberland Storage & Whse. Co., 700 Benton Ave.

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Chas. H. Platter & Co., Suite 228, 318 Cadiz St.
El Paso: George S. Thompson Co., Inc., 611-615 No. Campbell St.
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Houston: Leatherwood Supply Co., 2005 McKinney
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Scobey Fireproof Storage Co., 315 N. Medina

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Charleston: B. Preiser Co., Inc., 416 W. Washington St., P.O. Box 6118

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August, 1959

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Contents

Army Opens German Warehouse At Kaiserslautern **10**
Completed early in 1959 is a single-story cold storage warehouse for the U.S. Army at Rob-Kaiserslautern in Northern Germany, costing over $2 million dollars.

Transit Temperature Vital To Frozen Food **12**
Constant low temperature conscience for transportation of frozens is possible with newly introduced rugged combination-indicating-recording controllers.

Railroads Study Combination Trends For Perishables **13**
Three railroads operating out of Chicago are actively experimenting with combination trains of passenger and piggy-back cars. USDA report favors piggy-back and mechanical cars over water-ice for beef shipments, but car operators and icers criticise test methods.

Refrigerated Storage of Liquefied Propane Gas **16**
Atlanta Gas Light Co. pioneered the refrigerated storage of liquefied propane for use in "peak-shaving". The firm recently expanded this successful application.

Controlled Atmosphere Refrigerated Storages **22**
One simplified method of controlling atmospheres has proven a boon to fruit warehouses. This method is explained by a New York apple storage consultant.

Sure-Starts For Electric Motors **28**
Details how to service electric motor control devices is given in a pictorial article.

Departments

News Briefs	4	Meat Packing	26
What's New	7	Industry Meetings	27
Manufacturers News	9	Water Conservation	32
NARW-TRRF	11	NAPRE	33
Brewery Engineering	25	Question Box	34

THE COVER: 500-Ton Evaporative Condenser At ESSKAY

▶ ESSKAY's Baltimore plant increased condensing capacity and ended city water waste by adding a Baltimore Aircoil evaporative condenser to shell and tube system. Previously, water drawn from an Esskay well of limited output was supplemented by the City supply. After being fed through one 600-ton and three 200-ton shell and tube condensers, the water was used for slaughtering and clean-up processes.

Much of the time condensing requirements were greater than process requirements and the excess water was run directly into the sewer. Excess city water alone cost many thousands of dollars each year. With the new evaporative condenser, condensing water requirements never exceed process requirements and there is no reclaimable water going to the sewer.

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news briefs of the month

Plastics Fire Safety

Building Science News, a publication of the Building Research Institute, reported in July that a fire safety project is under way at Southwest Research Institute under the sponsorship of the Manufacturing Chemists Assn., to establish the basic factors affecting the use of plastics in building as related to fire safety. In May, RESEARCH FOR INDUSTRY, a news bulletin by the Sanford Research Institute reported the development of a plastic that won't burn. **Trichloropropene,** the plastic which will not support combustion can be combined with other plastics to make them fire resistant. (The SRI Bulletin is available from IR.)

Five Percent of Supermarkets Manufacture Own Ice Cream

Questions are being raised nowadays as to how much food processing the supermarket chains perform. ICE CREAM NEWS LETTER, a monthly publication by International Association of Ice Cream Manufacturers, reported that only 5 percent of the supermarket operators in the U. S. manufacture ice cream for their retail outlets. Figures disclosed at the Supermarket Institute meeting in Atlantic City, recently, indicate that these food marketers are engaged by the following percentages in the processing of food for retail: frozens, 2; cured meat, 6; bakery, 12; egg handling, 13; ripening bananas, 15; prepared delicatessen items, 24.

Automation Postponed

Management for the Fifth International Automation Exposition and Congress has announced postponement of the show scheduled for the New York Trade Show Building, November 16 to 20, 1959. Reasons for the postponement were not detailed, although it was hinted that the current anti-automation attitude of labor and some management played an important role in the decision.

Ohio Dairymen Fight Tax On Milk Coolers

Ohio Farm Bureau Federation has taken a State Tax Commissioner Ruling to the State Board of Tax Appeals in connection with a sales tax levied on bulk milk coolers. Farmers contend that bulk milk coolers and water heaters to clean the coolers are necessary to the health of consumers and therefore should be exempt.

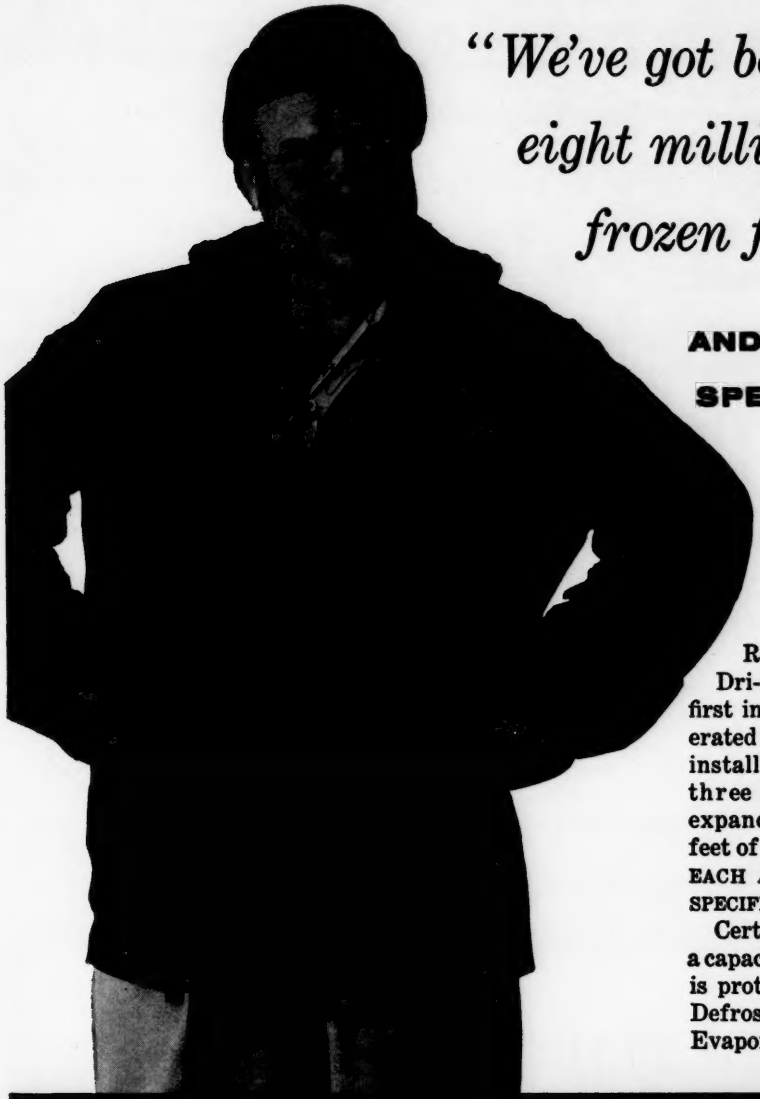
American Ice Reports Improved Earnings

Improved weather conditions have been credited with $131,000 first half net of American Ice Company in contrast with a loss of $64,000 for the same 1958 period. The WALL STREET JOURNAL quotes a company spokesman: " . . . if earnings continue at their present rate, directors will consider putting dividend payments on a quarterly basis". They have previously been paid annually.

Refrigerated Research By University of Alaska

Lower temperature and polyethylene lined containers hold down decay and discoloration of cabbage. These are the findings of the University of Alaska Agricultural Extension Service, in their report to the Agricultural Marketing Service, USDA, in a research study made for the U.S. Navy.

Fresh cabbage because of its high water content is preserved for a short time at high relative humidities. As the wrapper leaves wilt, rot attacks more rapidly if the air is moist. Cabbage stored in polyethylene liners at 32 F, suffered little shrinkage (less than 1% by weight) and the green color lasts much longer.



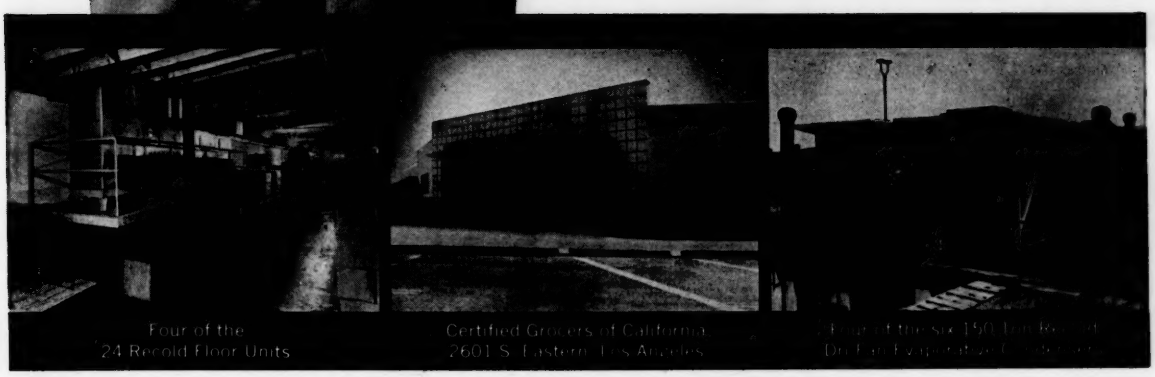
"We've got better than eight million pounds of frozen food to protect,

AND THAT'S WHY WE SPECIFY RECOLD"

says Dick Platt,
Chief Maintenance Engineer for the Certified Grocers of California.

Recold Water Defrost Floor Units and Dri-Fan Evaporative Condensers were first installed in Certified Grocers' refrigerated warehouse in 1949. Since the initial installation, Certified Grocers has made three additions to the warehouse... expanding from 15,000 to 54,000 square feet of refrigerated floor space... AND FOR EACH ADDITION, RECOLD EQUIPMENT WAS SPECIFIED AND INSTALLED.

Certified Grocers' big warehouse now has a capacity of 4,300 tons of frozen food which is protected by twenty-four Recold Water Defrost Floor Units and six Recold Dri-Fan Evaporative Condensers.



Four of the 24 Recold Floor Units

Certified Grocers of California 2601 S. Eastern, Los Angeles

Four of the six 150 ton Recold Dri-Fan Evaporative Condensers

RECOLD CORPORATION

7250 E. Slauson Ave., Los Angeles 22, Calif.

There's still time to get your FREE GENETRON CARRY-STAND

(If you haven't already got yours, get it now!)

Offer good through August with purchase of 22 lbs. or more of

genetron® SUPER-DRY REFRIGERANTS

It's a Cylinder Carrier!
Grab it anywhere! Carry ring is 22 inches around.
Built to last! All joints are arc welded.
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Secure! Won't slip off. 13/16" neck ring screws all the way onto cylinder.
genetron 12

Interchangeable!

Ideal for service use. Use on any 10 lb. or 25 lb. refrigerant cylinder.

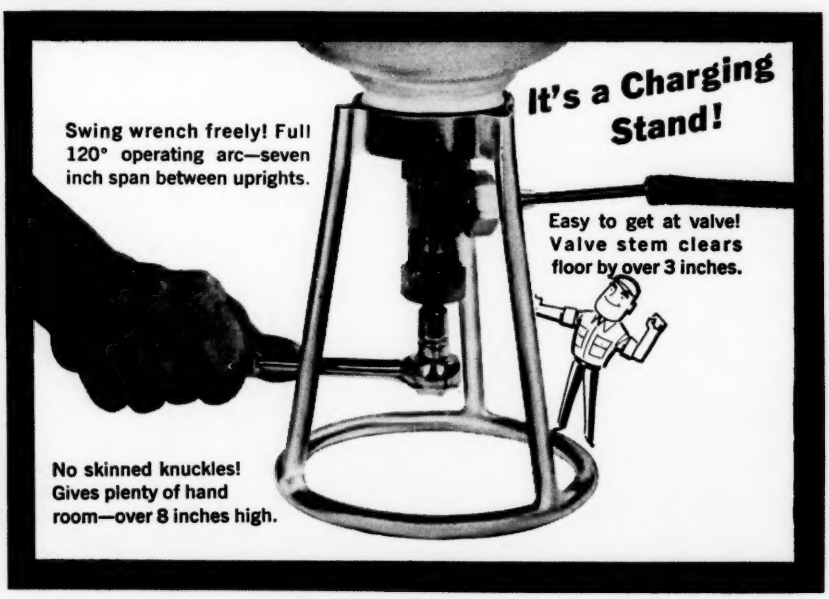
Big Value!

Worth at least $5 retail! Yours free when you buy "Genetrons" during August. Don't miss it!

A GIFT FROM YOUR WHOLESALER

SUPPLY LIMITED!

Only One to a Customer!


It's a Charging Stand!
Swing wrench freely! Full 120° operating arc—seven inch span between uprights.
Easy to get at valve! Valve stem clears floor by over 3 inches.
No skinned knuckles! Gives plenty of hand room—over 8 inches high.

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What's New

MACHINERY
APPLIANCES • PROCESSES

Another Rotary Booster Introduced
Packaged Equipment, Plastics Grow

▶▶MULTI-STAGE REFRIGERATION at low temperatures and pressures have produced many advocates of the rotary compressor as a booster. Another manufacturer has entered the field now with a rotary series. Also, the trend toward packaged plants has seen even the custom installation adapted to factory fabrication and/or assembly. A well known West Coast manufacturer recently delivered such a plant for process cooling of solid propellant rocket fuels.

Low temperature liquid handling has posed a problem to the refrigeration field. One manufacturer modifies a basic pump for this purpose. Plastics gain ground again in piping applications, but the steel tubing industry fights back. Clothing may be somewhat removed from the refrigeration man's thinking, but industrial applications such as cold storages, food freezing facilities and environmental laboratories are interested in recent development of work apparel for these conditions:

Vilter Introduces Rotary Booster Compressor Series

▶ANNOUNCED JULY 2, was the addition of a rotary booster compressor series by the Vilter Manufacturing Co., Milwaukee, Wis. Designated VRB, the Vilter rotary booster is designed for low temperature applications with ammonia, Refrigerant 12 or Refrigerant 22. Especially suited for use in packing houses, dairies, cold storage warehouses, or in other industry where low temperatures are required for process work, the VRB will readily fit into multi-stage systems as the first or booster stage. Of the sliding vane type, the VRB ranges in capacity from 4 through 400 TR, depending on size and operating conditions. Claimed to feature high efficiency, compactness, versatility of application and ease of maintenance, the machine is internally lubricated by means of a mechanically driven forced feed lubricator.

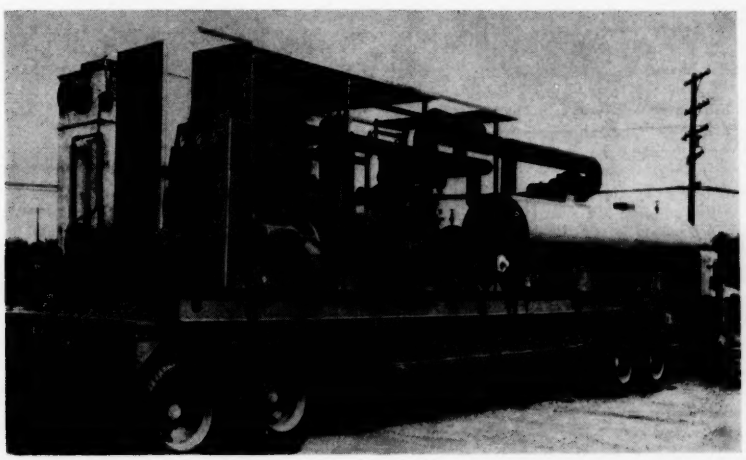
Kohlenberger Packages Rocket Fuel Cooler

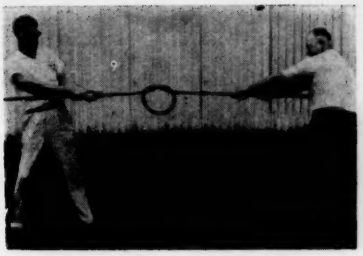
▶ENTIRELY SELF-CONTAINED, a custom engineered packaged process cooling unit has been delivered by Kohlenberger Engineering Corp., Fullerton, Calif., to Aerojet-General Corp.'s nitrocompound plant at Sacramento. Designated the KMC-40, this 10x39x8½-ft, 44,000-lb chiller package has a cooling capacity of 24 TR. A 2-stage plant, it is intended for large volume process cooling of solid-propellant rocket fuel.

Primary refrigerant for the 2-stage system is ammonia and the secondary refrigerant is a methanol-water solution chilled to minus 40 F while circulating at 75 gpm. The chiller package includes centralized control with power panel and gauge board located at one end of the unit. Duplicate auxiliaries are equipped with selector switches to put either in operation with the other on standby.

Thermostatic controls maintain a "hands-off" operation in accordance with methanol solution requirements. Safety thermostats and cut-outs provide automatic protection against freezup, high or low pressure, or oil pressure failure. First stage compressor is a Kohlenberger heavy duty vertical and the second stage is a multi-cylinder compressor unit.

Pictured below is the entire unit leaving the Fullerton, Calif. manufacturer's plant.





Flexible Steel Tubing

▶LECTRONSONIC is the trade name for a new line of welded steel tubing designed specifically for heat exchanger use and marketed by an old-line boiler manufacturer in Connecticut. Subjected to five years of extensive field tests, the new material has proved equal or superior to seamless carbon steel tubing and shows price savings of from 10 to 32 percent over the grades of seamless tube it has been designed to replace.

Although it will never have to suffer such contortions when used in heat exchangers, this new welded steel tubing can literally be tied in a knot without damage, as two muscled B&W employees demonstrate in the photo. The tubing is formed from flat metal strip with the edges joined by electric resistance welding. Result is a tube as good as more expensive tube made by piercing and drawing a solid steel cylinder.

Plastic Pipe Gains Ground

▶ESTIMATED SALES of plastic pipe is placed at $60 million dollars this year by George Reed, chairman, Plastic Pipe Research Council, as reported by the NEW YORK JOURNAL OF COMMERCE. Retarding its wider use, the article reported, have been Municipal and State Building Codes. However, Florida, California, Kentucky, Maine and Wisconsin have recently modified their building codes to permit the use of certain classes of plastic pipe.

Two new formulas, according to Reed, have resulted in the wider acceptance of plastics by industrial users. The improved materials are acrylonitrile-butadiene-styrene pipe called Type II ABS, and high density polyethylene and polypropylene materials. Techniques for extrusion of the pipe itself and new methods of joining have also brought about increased acceptance.

Growing industrial applications include salt water, natural gas, and high hazard chemical handling, electrical conduit, and food processing. Momemtum is also being gained in the use of plastics in air conditioning (sweet water), in refrigeration on the condensing side, in radiant heating and underground electrical conduit.

Plastic pipe sales in 1958 were $55 million. Three-fourths of the plastic pipe market was comprised of polyethylene, with about 7 million pounds of Type II ABS, and 6 million pounds of polyvinyl chloride material being consumed in pipe applications.

. . . More ▶

WHAT'S NEW (Cont'): Personnel Attire Gets Attention

Light-Weight Foam Insulates Freezer Clothes

FOAMED PLASTICS have now invaded the clothing field. Freezer clothing which is light weight, flexible and strong is made possible by a urethane foam introduced in June by the National Analine Div., Allied Chemical Corp. This flexible foam is closely related to the rigid urethane foams which have been gaining prominence throughout the refrigeration industry as a thermal insulation material.

In the growing frozen food and ice cream industries, workers must often perform their jobs inside freezers or hardening rooms. Urethane interlined clothing provides not only utility and comfort, but these freezer garments appreciably reduce out-of-freezer time, resulting in increased production.

Particularly suitable for use where sanitary considerations are important, the garments are described as rugged, durable and wear resistant. Many will meet the qualification of "wash and drip dry" since the foam will permit frequent laundering or dry cleaning.

Conditioned Apparel

FRIGIVEST is the name of a hood and vest developed for workers who have to endure hot summer sun on Southwest construction jobs. *Dry Ice* is used to cool the wearer according to the MILWAUKEE JOURNAL.

No Longer Cold In There

NO MORE frost-bitten noses, cheeks or ears for cold-storage workers. A new special face protector is now manufactured by a New York City firm. It is made of a new soft cotton knit fabric, recently developed for the U. S. Navy. The protector slips easily over the head, and snugs comfortably to the face, as pictured. A single size fits all wearers. Priced at $1.50, the protector is offered to all cold storage industries, along with a complete line of *Refrigi Wear* insulated garments.

Sub-Zero Head Gear

INTRODUCED much earlier in the year were three types of close-fitting head gear for three cold temperature ranges. Manufactured by a Carbondale, Penna., firm specializing in safety industrial, sport and military protection clothing, a *Snowflake* helmet is made of knitted nylon, weights only ½ oz., and fits all head sizes. It is designed for use in temperatures at the freezing level.

Designed for temperatures down to zero is the *Frost King*, made of light weight woven nylon, available in small medium and large sizes. *Polar* is the name applied to the third headpiece, which is designed specifically for sub-zero temperature levels. Available in three sizes, equipped with fabric ties that can attach to safety hat head bands, it has found numerous uses in environmental and wind tunnel applications.

Neoprene Coated Gloves

THREADING a needle or picking up a pin with gloves on is no chore at all, according to the manufacturer of neoprene-coated industrial gloves pictured. Used extensively in food, dairy, fishing, chemical and petroleum industries, the gloves are now available in three sizes and styles. Called *Flexiprene*, the new gloves reduce finger fatigue and clumsiness usually experienced by wearers of coated industrial hand gear.

Unsafe Work Garments

ARE YOUR WORKERS "dressed to kill"? It's no joke. Unsafe work clothing can help lead to accidents. The Institute of Industrial Launderers has helped draw up safety standards for work clothing in connection with the National Safety Council and the American Standards Association. The Institute, through its president, John J. Roche, recently pointed out some of the commonest, yet most dangerous hazards in work clothing.

Statistics show that a dangling shirt cuff, trousers with cuffs, dangling ties, dangling belts, and rags and tags have contributed most of the sky-rocketing compensation accident claims. As a public service the Institute offers to prepare individually written articles, illustrated, which are entirely institutional and non-commercial in nature, to help industry publications feature garment safety. The offer stands for Association publications.

Indicating Dial Thermometer

LARGE, easily read dial in a reinforced plastic case in several color selections, are the features of a new dial thermometer introduced by a New York control manufacturer. Ten scales are applicable to the instrument and elements of the same scale range are interchangeable. Now, those nattily attired freezer workers can more easily read the temperature from a distance than they could with the conventional thermometer, but it won't make any difference since they will be working in reasonable comfort.

Time To Check On Those Roller Bearings

Range of sizes of Link-Belt spherical roller bearing

WARMER production season also brings on bearing problems. Link-Belt Company, Chicago, recently introduced a new high capacity spherical roller bearing which combines three major design improvements. Features are maximum diameter and quantity of convex rollers for each size; precision machined, centrifugally-cast bronze retainers; and high, heavy inner race shoulders. All components are designed in optimum balance to assure long carefree bearing performance on severe installations.

High, heavy inner race shoulders

Centrifugally cast bronze retainers

Largest convex rollers

PERSONS IN THE NEWS—

Businessmen, Engineers, Manufacturers

Turcotte

Hueg

Older

Turcotte Joins NIA Staff

▶▶NEWEST MEMBER of the National Ice Association staff is **Charles L. Turcotte.** Formerly an administrative assistant for the Wood Office Furniture Institute, he had participated in program development for that organization which included responsibility for merchandising, promotion and research activities.

A graduate of George Washington University, "Chuck" Turcotte served two years in the U. S. Air Force before starting his business career. His experiences included terms as resident secretary, Tulsa, Oklahoma YMCA and claims Adjuster for Liberty Mutual Insurance Company. He is married and resides with his wife and 6-months old daughter in Alexandria, Va.

Ice Industry Meets Changes

▶THREE-QUARTERS of the way toward completion of another year, the NIA is moving along nicely with preparations for an outstanding National Convention in Dallas, Texas, come October, said **William T. Jobe,** Executive Vice-President and General Counsel in a recent interview. All functions of the Assscciation are progressing in orderly fashion. Jobe said the top executives are responding to the new dues formula adopted in Miami, last November. The same attitude has been experienced with regard to other changes which were made through amendments to the Association's Constitution and By-laws.

Civic Duties

▶AT MID-YEAR, a prominent ice man and another prominent cold storage operator in Milwaukee were both appointed to the Milwaukee Association of Commerce 1959 nominating committee. They are **John H. Kopmeier,** president of Wisconsin Ice & Coal Co., and **Philip G. Kuehn,** president of Wisconsin Cold Storage Co. Both are directors of the Milwaukee Association of Commerce.

Storage Director

▶UNION TERMINAL Cold Storage Co. of New York announced early in July that **Milton A. Kimmelman** was named a director of the company. He also became a director of Union's affiliate Manhattan Refrigerating Co., according to the WALL STREET JOURNAL.

Manufacturer's Personnel

▶▶MID-YEAR appointments have been announced by Recold, Kohlenberger, York, Baltimore Air Coil, Superior Valve and others. **Leo J. Munchhof,** associated with Recold Corp., Los Angeles, since 1956, has been appointed advertising and sales promotion manager by **"Hy" T. Jarvis,** the president. Munchhof had been the assistant Manager since 1957 with prior experience in pricing and invoicing. He had previously been with Dayton Manufacturing Co. and U. S. Electrical Motors in similar capacities. He is a graduate of Occidental College and University of Southern California.

New Buyer

▶KOHLENBERGER Engineering Corp, through its president, **C. R. Kohlenberger,** recently announced the appointment of **Herbert G. Hueg,** as purchasing agent. Before joining the Fullerton, Calif. firm, Hueg had been the chief industrial engineer at Sterling Electric Motors, Inc., had held an engineering management training program post at North American Aviation, and was time and motion study engineer for Pacific Pumps, Inc. A state licensed public accountant, he is a graduate of Los Angeles State College.

Controller

▶APPOINTED controller at Baltimore Aire Coil is **Morris B. Older,** according to announcement by **John Engalitcheff, Jr.,** President. Older will supervise financial operations of the company, including the accounting, budgeting and credit departments. This CPA has operated his own public accounting firm and has been consultant to BAC for the past 13 years.

Trucking Expert

▶PAN-ATLANTIC Steamship Co., announced recently that **William O. Gohlke** has become manager of its 500 truck Refrigerated Division. In 1946, according to the NEW YORK JOURNAL OF COMMERCE, Gohlke entered the truck business and in 1955 founded Federal Trucking Co. of Federalsburg, Maryland. In four years that operation has grown from one to 60 refrigerated trucks operating over a national net work.

Manufacturer's News

▶▶NOT ALL NEWS emanating from manufacturers, engineering firms and business houses utilizing industrial refrigeration, concerns personnel. Re-organizations, results of test procedures, and even philanthropic or historic activities are worthy of comments now and then. However, perhaps the most important manufacturers' news item is really a group announcement, coming from the association which represents 95 percent of the American refrigeration-air conditioning producers, the ARI.

Recently one of the nation's leading packers and producers of ammonia formed a new group. At the same time that Rapid Ice was being introduced in the United States (see INDUSTRIAL REFRIGERATION, page 22, July '59), two other firms announced the development of block ice systems.

ARI Reports On Installed Central Station Systems

▶AIR CONDITIONING and Refrigeration Systems Section, Air Conditioning and Refrigeration Institute, reported in July that the installed value of central station air conditioning systems which went into operation in the United States during 1958, was $550,730,000. The installed figure includes duct work, grilles and other elements besides the refrigerating plants which make up the systems. The 1958 figure was 8 percent below the 1957 estimate, but ahead of any previous year.

The ARI release indicated that approximately one-half the 1958 volume went to comfort condition multi-room structures, such as office buildings, apartments, etc., while the other half was about equally divided between industrial and commercial installations. The ARI Section pointed out that big systems were still accounting for the largest share of the industry's sales.

Greatest potential appears to be in the industrial application field where less than 10 percent of U. S. factories, plants and other industrial establishments now have air conditioning. "American industry is finding that controlled temperature and humidity improve the function of both mechanical machine and the human machine, the two major factors in efficient production", said Rudy Berg, President of ARI.

Armour Regroups Chemicals

▶ANNOUNCED early in June is the formation of Armour Industrial Chemical Company, a new grouping. Under the direction of M. E. Lewis, general manager, the new division comprises fatty acids, fatty nitrogen derivatives and the ammonia divisions. R. S. Passmore will continue as ammonia division manager and P. W. Fulford, NH_3 sales.

Armour Industrial Chemical Co. moved its management and sales personnel to new and larger quarters at 110 North Wacker Drive, Chicago.

(Continued On Page 39)

New U. S. Army Cold Storage At Kaiserslautern

By JOHN A. HAWKINS

Aerial View of USA Cold Storage at Kaiserslautern, Germany, Shows 625x250 ft Plant, with Administration Buildings, Machinery House, and Rail-Truck Access.

▶▶▶SINCE RETURNING from a recent tour and observation of military subsistence supply activities in Europe, I often have been asked about the Army's new cold-storage plant at Rob-Kaiserslautern in Germany. This plant—probably the largest cold-storage warehouse in all Europe—was only recently completed and opened for business. It forms a new link in the subsistence supply system furnishing perishable food for the U. S. Armed Forces in Europe.

The $2,140,000 project was begun by the U. S. Army Construction Agency in October 1956 and completed early in 1959. It was officially opened March 2 with a ribbon-cutting ceremony by Brig. Gen. Robert J. Fleming, Jr., Commanding General of Communication Zone Advance Section, and Brig. Gen. Joseph R. Ranck, Quartermaster, U. S. Army in Europe.

The plant is administered and operated by the Communication Zone QM Supply Center at Giessen, Germany; there Col. Joseph S. Kujawski commands. The commanding officer at the plant is Maj. William C. Lansford. Lansford's staff comprises four other officers, eight enlisted men, one U.S. civilian, and 163 Germans.

Physical Features

Total area of the cold-storage building is 126,000 sq. ft. (inside dimensions). The plant is located on a site encompassing about 18 acres along the autobahn between Kaiserslautern and Ramstein. Other facilities include an administration building, and a separate power plant building. There is also a deep well for water supply; a water reservoir; sewage treatment plant with septic tank, pump house and three sand-filter beds; and a guard house and bicycle shed.

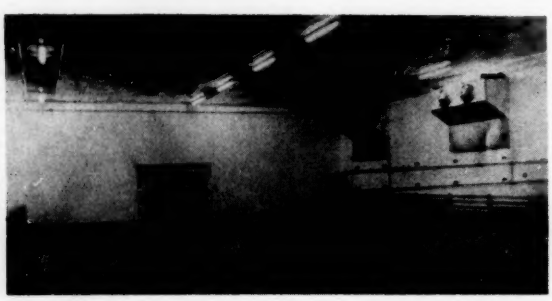
A railroad runs along one side of the plant. Spur trackage permits spotting 25 European refrigerator cars. The opposite side is designed to accommodate motor-carrier equipment. It has ample paved areas for truck maneuvering. Mechanical handling equipment consists of 24 electric fork lifts (2000-lb capacity each) along with galvanized sheet steel pallets (40x48-in), 4-way entry.

The one-story reinforced concrete cold-storage building is 205x625 ft. Ceiling height permits stacking to 12 feet under the overhead coils. Gross cubic feet of refrigerated space is 1,244,000. Floors and ceilings are insulated with *Expansit* K25 (synthetic resin). Both outside walls and partition walls are insulated with corkboard covered with two layers of plaster. Roof girders are of prepressed concrete and the roof is constructed of prefabricated reinforced pumice concrete slabs. Fluorescent lighting is installed throughout.

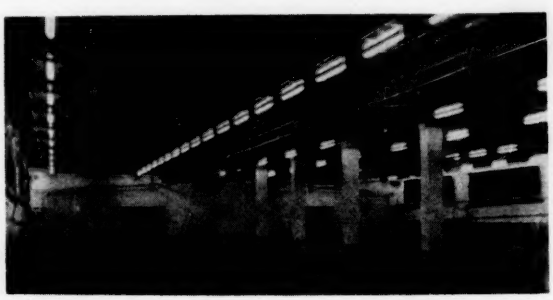
Storage Sub-divisions

The building is divided into six cooling sections of approximately 16,250 sq. ft. each. One section is divided into four rooms of about equal area. Three of the main sections are carried at zero F. One section—for ice cream, sugared fruits and juice concentrates—is carried at minus 10 F. Another, carried at 32 F, can be converted from chill to freeze. Depending upon requirements, the four small rooms are carried at temperatures between 32 and 45 F.

Each section has four doors, two to each opposite end. Doors are 10 feet wide and about 8 feet high, manually operated. The doorways are equipped with flexible vestibule swinging doors and automatic air curtains to minimize the entrance of heat when doors are opened.

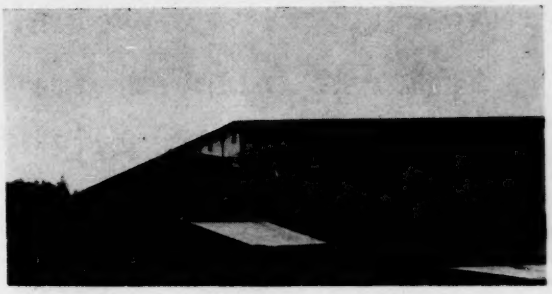


Typical Chill Room. There Are Four, Each 4275 Sq. Ft. Equipped With Several Twin-Fan Cooler Units.



Typical Freezer Storage. There Are Five, With One Convertible to Chill, Each 17,560 Sq. Ft. Using Fin Coils.

Refrigerated Motor Carriers Operate Out of the Opposite Side from Rail Service. Platforms Are Equipped With Horizontal Single Leaf Sliding Doors and Air Curtains, With Flexible Swinging Doors at Opposite End of Entries.



Rail Siding at USA $2,500,000 Cold Stores Plant for the Northern Area Command, Germany. An Autobahn Parallels the Rail Line. Well Lighted Paved Access With Dock Ramps Ease Handling from Low-Bed Vehicles Also.

Refrigerating System

Refrigeration is applied by recirculating ammonia with overhead bunker and fin-type wall coils in the five large sections. Wall-mounted unit coolers are installed in the four smaller cooler rooms. Direct connected, electric-motor driven, rotary compressors are used for boosters in the conventional mechanical compression refrigerating plant. An 800-Kva Diesel-electric generating plant stands by to offset power failure.

The Administration building contains offices, store rooms and toilets and has direct access to the cold-storage. A canteen, dressing room, toilets and showers are provided adjacent to the cold storage for the warehouse and engine room employees.

The storage capacity of the plant is about 8,000 tons of frozen and chilled food items. Current usage anticipates the receipt and distribution of about 3,000 short tons (6 million pounds) of perishables each month.

John A. Hawkins, an honorary member of NARW and past national president of NAPRE, is assistant chief of the Requirements and Distribution Division, Headquarters, Military Subsistence Supply Agency, Chicago. Under the single-manager concept of unification in defense supply activities, the Agency directs the purchase, inspection, storage and distribution of food procured wholesale for the Army, Navy, Air Force and Marine Corps. It spends about $700 million for that purpose annually. Mr. Hawkins recently returned from a 30-day tour of Army supply facilities in Europe.

Frozen Food Code Approved By AFDOUS

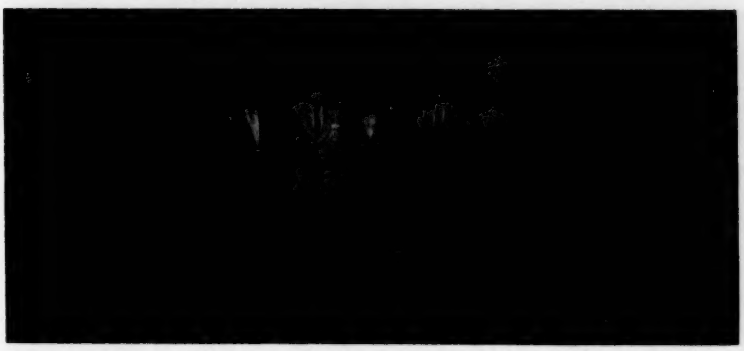
▶▶LONG AWAITED, a Frozen Food Handling Code was unanimously adopted by the delegates of the Association of Food and Drug Officials of the U. S. at their annual convention in Boston, Mass. on June 24. The model regulation under preparation for three years, is suggested legislation whereby states desiring to establish controls, may do so. The Code offers a practical and reasonable method for the proper handling of frozen foods.

Recommend Reasonable Code Enforcement Program

AFDOUS, however, urges caution and restraint in adopting the Code for immediate use, since much equipment will not meet such regulations at the present time. Zero degrees Fahrenheit is the minimum temperature to which frozen foods should be subjected during transportation, storage and retailing.

AFDOUS requested the help and cooperation of a number of other industry associations involved in the frozen food picture. Most prominent was the National Association of Frozen Food Packers. Recommendations of the National Association of Refrigerated Warehousemen and other groups were also considered.

TRRF Executives Meet At Colorado Springs



Officers, TRRF, are l. to r., Dr. Walter A. Maclinn, director and secretary, Millard W. Young, president, Garth A. Shoemaker, past president, Gilbert J. Stecker, treasurer, Franklin D. Newell, Jr., vice-president.

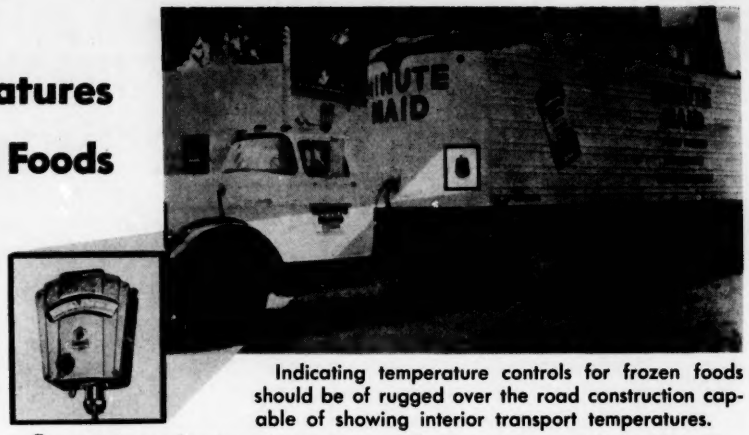
▶▶DISSEMINATION of information for the practical application of results from over 60 research projects, is the assignment and objective of a committee recently formed by The Refrigeration Research Foundation. The group was activated at the executive committe meeting of the Foundation early in June. The new committee will also review a number of projects to determine how the Foundation can be of more help to member refrigerated warehouses.

The executive committee meeting at TRRF headquarters in Colorado Springs, with all members present, spent considerable time getting acquainted with the physical properties of the Foundation and its research program. They met with the staff and inspected the Foundation's library which is said to be the world's repository of refrigeration information.

Some 118 scientific, technical and trade periodicals are reviewed, some daily, some weekly, some monthly, from 7 foreign countries in addition to U. S. Journals. The Foundation library index has over 25,000 references, and the file case include over 4400 original reprints of research results pertaining to the refrigerated warehousing industry.

Transit Temperatures Vital To Frozen Foods

By: M. SCOTT CASSELL



Indicating temperature controls for frozen foods should be of rugged over the road construction capable of showing interior transport temperatures.

For certain applications the control may be mounted in an inverted position as indicated on the trailer. In addition to direct reading, the refrigeration controller should be recording to give a continuous picture of the transit temperature. USDA recently recommended that the indicating temperature devices be placed near the side for easy reading in piggy-back operation.

▶▶▶CONSTANT LOW TEMPERATURE warehousing facilities for frozen food storage has long been recognized as an important factor in the distribution of many food items. It has come to recent notice, however, that this constant low-temperature factor is not always true in the transportation of these same food items. It seems that temperature constantcy between warehousings has escaped consideration in many instances.

In every means of transport, some form of refrigeration and/or insulation is being provided, but maintainance of the necessary constant low temperature during transit has proven to be the factor that influences repeat purchases of the buying public when flavor, crispness and other comparative qualities to fresh food is considered. Packers of frozen foods are concerned over the fact that sales of such items amount to only four percent of total food sales.

Regulating and Recording In-Transit Temperatures

While the transportation firms are not intentionally neglecting the interests of one of their best customer groups, some certain solution to the problem is needed. With this thought in mind, several manufacturers of temperature control systems have designed various methods of regulating the low temperature in transport.

Because of conflicting effects of wind velocity, elevation and sun, the transport in motion has an altogether different problem in temperature constantcy than does a stationary building. The temperature control manufacturers have spent a great deal of time and money in research to arrive at a solution to the problem. One such company reasoned that most marine and rail equipment received special consideration by manufacturers for those fields; why then shouldn't the rail and truck reefer control components be considered in the same light. Further, why shouldn't recording devices, successful for stationary uses, be similarly constructed for over-the-road combined temperature control and recording.

In a recent discussion, Wayne A. McGrew, Vice president of a Utica, New York firm presented several enlightening thoughts on the subject. He pointed out that as a result of his firm's researching activities transit type temperature controls and recorders have been developed to not only regulate the temperature at a required level, but to also make a visible record of temperature to show variations if they should occur.

Flavor Losses Shown To Be More Rapid Than Supposed

He also said that tests conducted by the U. S. Department of Agriculture show that strawberries can be kept for a whole year at a zero F temperature; but at 10F the same berries will deteriorate between two and three months. At 20F the berries lose quality in six to twelve days and at 30F loss of color and flavor is noticeable in 24 to 48 hours.

Other fruits, McGrew said, are even more sensitive. He continued with the idea of critical temperatures and pointed out that in developing the system which his firm recommends for frozen food transportation units, consideration had been given to the entire cubic volume under control and not to just a single spot in the mass. In this way, he said his firm felt that required temperatures can be maintained and proof of fact recorded.

McGrew discussed several cases in which the transit recording controller units had been in successful application. He spoke of Minute Maid Corp. which had installed the temperature control systems on most of their fleet of nationally operated trucks. Results had more than proved the value of the installation.

McGrew emphasized that controls particularly suited for highway travel require rugged simplicity. They should involve no delicate bi-metallic or bellows-type mechanism, or complicated electronic controls. Their working principle should be nothing more complicated than the expansion and contraction of an element, such as mercury, under temperature changes. He explained that mercury filled thermal elements may be constructed to withstand internal pressures up to 2000 psi. Lever mechanisms are best because they are positively operated without additional electric, pneumatic, or hydraulic build up.

Frozen Food Future Stressed

Other leaders in the temperature regulation field have stressed the fact that they are also producing temperature controls with similar thoughts in mind. They say that the frozen foods industry is expanding and that there is little doubt that acceptance of the buying public is affected by the fact that frozen foods have a memory very adversely influenced by temperature rises during transport. It is felt that recognition of the importance of the in-transit temperature by frozen food distributors, transporting firms and retailers will result in an overall acceptance.

In reaching the other half of America's 50,000,000 families, the frozen foods industry will be very substantially dependent upon the accurate and continuous temperature records that McGrew's firm and others are marketing for the conscience of the industry.

Perishable Transportation

Railroads Study Combination Trains

USDA Report Favors Reefer Piggy-Back For Beef Shipments[1]

▶▶▶ RAILROADS are studying the mixed movement of flat cars with their passenger trains. Three roads operating out of Chicago have already experimented with piggy-backing reefer vans on flat cars in scheduled passenger runs. One railroad in June, brought a passenger train into Chicago containing 40 such cars. It was moving mostly a strawberry crop from Iowa.

Beef shipments are now being handled by mechanically refrigerated rail cars and piggy-backed truck trailers, according to United States Department of Agriculture. Tests, the Agricultural Marketing Service says, indicate that these vehicles can hold temperatures as well as, or better than, the water-ice car traditionally used for these shipments.

Take Issue With Experts

Industrial icing firms and some car operators were quick to point out that USDA findings were made when using cars without circulating fans. It makes considerable difference, they say.

Beef should be cooled and held at temperatures between 31 to 35 F. Unless transit temperatures are carefully controlled, the meat may lose some of its fresh appearance and good quality. That's why AMS transportation specialists are interested in finding the best possible way to move freshly killed beef from slaughter houses to consumers.

Compare Three Car Types

Compared in the recent USDA tests were beef shipments in mechanically refrigerated rail cars and trailers-on-flatcars as they traveled from Lincoln, Nebr., to Philadelphia, Pa. H. D. Johnson, R. W. Penney, and Robert F. Guilfoy[2], found that the "piggyback" or trailer-on-flatcar offers a definite advantage in that it can be driven directly from the rail yard to the wholesale or retail outlet. This eliminates intermediate unloading or warehousing, and lessens the chance of spoilage during transfer.

Mechanically refrigerated rail cars, according to these researchers, offer the same basic advantages as "piggy-backed" trailers. When properly functioning, they are capable of maintaining the proper air and commodity temperature en route.

Non-Fan Car Tested

They also proved to be considerably more effective than water-ice cars, said AMS. In a typical water-ice car which was included in the research study, temperatures ran as high as 49 F, and fluctuations were greater than in any of the mechanically refrigerated cars and trailers.

However, the USDA report acknowledged that the water-ice car lacked circulating fans and therefore did not have enough air movement to keep the temperature uniform throughout the load. Air circulation in this car depended entirely upon natural convection. While standing still in the yard, the car became noticeably warmer due to the lack of air circulation and the sun's heat.[3]

Suggests More Tests

An interview with the operating vice-president of a railway ice and service firm in which a preview of the USDA report was submitted, prompted these remarks: "Tests recently made with the shipments of meat using, for a comparative performance, a refrigerated truck-trailer, mechanically refrigerated rail car, and an ice activated rail car, were certainly timely but not entirely fair to the ice industry, because a non-fan ice activated rail car was used instead of a modern fan car.

"There is no question but what adequate temperatures can be maintained in an ice activated car when equipped with fans. USDA experts have run many tests over the years and I am sure the records will confirm my statement. Future comparative tests should include the use of a modern fan equipped ice activated rail refrigerator car".

Another inquiry of a vice-president-engineering with a nation-wide public service company brought these remarks: "No doubt, there is a need for some study, testing and experimentation in developing the best and most suitable method of moving freshly killed beef from slaughter houses in the midwest to other parts of the country. However, after some study of the report being presented, we feel that the test therein indicated has not been thorough and complete as to suggest a solution.

"The report indicates that only one water-ice car was used in the test and stated that this car was not equipped with fans. Although water-ice cars have been used traditionally to ship meat products, we believe a thorough investigation will reveal that cars without fans are being replaced with fan cars as rapidly as possible. The report states the temperature fluctuations in this car were much greater than in the mechanical cars and trailers. This would be the expected condition since no fans were available to provide the necessary circulation.

Salt Proportions Important

"No mention was made as to whether any salt was used with the water-ice car. As industry persons would know, water-ice has a melting temperature of 32 F and is not expected to obtain a 31 F reading in the car without the addition of a small percentage of salt. This would be especially true in a car without fans. We would like to suggest that the tests be repeated using water-ice activated cars, with modern fan circulation and using the prescribed amounts of salt.

"At one point the advance report indicates that temperatures higher than desired maximum were found in the piggy-back trailers; a condition that could be corrected by proper ducting. And, that mechanically refrigerated cars, when properly functioning were capable of maintaining proper air and commodity temperatures. These statements, of course, are unquestionable. How, ever, they do give rise to one other consideration that was not mentioned in the report. That is, *the humidity conditions found in the various test cars.*

... More ▶

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[1] A complete report on the AMS study on "Rail Car and Piggyback Transportation of Freshly Killed Beef" may be obtained without charge from the Office of Information, U. S. Department of Agriculture, Washington 25, D.C.

[2] Mr. Johnson is a transportation economist, and Mr. Penny and Mr. Guilfoy are mechanical engineers in the Marketing Research Division of AMS.

[3] Of 15,500 refrigerated rail cars currently equipped to transport carcass beef, reports AMS, only about 50 have mechanical refrigeration units which operate under their own power—that is, not through the car axle.

"One of the most important factors involved in proper storage and handling of freshly killed beef is the maintaining of a high relative humidity. If the humidity is too low the meat is dehydrated with a considerable loss in weight. It is believed that shippers would be more concerned with maintaining full weight of their commodity than any other one factor."

Current Rail Icing Problems

Perhaps a better excuse for boosting the mechanical car – and its newest competitor, the flat-car-riding semi-trailer – over the ice car in cooler temperature service, would be the relatively declining ice supply at certain geographical points. Stepped up perishable freight schedules have reduced icing stations between origin and destination. In effect it more than doubles the demand at these fewer icing stops.

Supplemental ice can be carried back over right-of-ways from a discontinued icing station plant in reefer cars, without too much difficulty. But, when the ice has to be carried in heavily insulated cars in the same direction as the perishables it is to refrigerate, both the road and the industrial icer start scrambling for more economical means of supply.

It could mean dismantling or moving of the by-passed plant to the new stop, in order to provide added capacity. Purchase of nearby commercial ice plants or their output, is another answer. Expansion of the overtaxed stop is also logical, but according to most operators, would hardly pay for the few months peak –a demand that even misses in drought years.

New Ice Makers Help?

Another answer may be the new quick-freezing block-ice machines recently introduced into U. S. production. Added to an existing icing station, they could give peak protection or even become the main producer year around.

It has been the impression that mechanical car production has not kept pace with the expanding low temperature service demand. In mid-July the Association of American Railroads showed 2400 such cars on order and undelivered, although 700 of those were only ordered in June. Frozen commodities are without a doubt going into those cars when delivered, and frozens can be a year-round business. Those mechanical cars just won't be available in quantity at fresh perishable peaks.

Mechanical car proponents will use the newest icing problem and the USDA report to promote dual purpose mechanical cars. Will the truckers, whose equipment manufacturers just adopted truck-trailer rating standards, also come up with dual purpose vans for piggy-back operation?

Piggy-Back Popularity Rises

There are at present only a small number of piggy-back trailers hauling beef. However, this comparatively new type of rail-truck service may very well gain in popularity, says the USDA report. Perhaps the trailer-on-flatcar advantages which AMS reports with beef, may gain popularity in the entire cooler perishable range. Especially with the aggressive truck-trailer manufacturers and operators tightening up on the refrigerating qualities of their equipment[4]. Their ultimate objective tho, is believed to be the frozen food transport business.

In the meantime the railway car operators and industrial icers are not going to roll over and play dead. The reefer operators paid close heed to previous USDA tests, such as the report "Thermostatic Control For Fresh Perishables In Ice-Refrigerated Railroad Cars"[5], and "Test Results on Eleven Car Trans-US Lettuce Lift"[6].

Three-way Competition

Rail icing firms tell IR they have noted and look for more and more conventional ice cars to be equipped with circulating fans and thermostatic control. The roads look for icing point capacity to be expanded, and refrigerating machinery will go more automatic as will the actual production. Harvesting and icing have already become highly mechanized.

All the while the entire perishable food industry will be watching those mixed train experiments. The shipper is interested in better service, but not at much more expense. Car operators already in a long haul service may decide to concentrate even more on mechanical cars, while their icing service friends may turn to more refrigerated warehouse service at growing and freezing centers.

The short-haul trucker may find it advantageous to team up with the railroad, and/or the railroad may operate the terminal trucking lines. The refrigerating industry may look as though it can't lose in any eventuality, although the truck equipment manufacturer and service contractor appear now to gain most.

Railroads' Decision

In the end it will be the railroads which decide the issue. However, they have non-refrigeration problems to settle first. Ed Kandlik, Financial News Writer for THE CHICAGO DAILY NEWS wrote:

"The big problems to be solved on passenger runs involve working rules for crews, state laws and slack.

"In a 'mixed train' the crew demands a through freight train scale of wages. On a freight train 100 miles constitutes a day's work. On a passenger train 150 miles is a day's work.

"Mixing the two types may mean a higher labor cost per train–and of course, more work accomplished.

"In some states the railroad has to get authorization to operate mixed trains, although such trains are common in outlying Western branches.

"Slack can also be a problem in in handling piggyback operations.

Some Operating Problems

"While railroads have been successful in handling piggyback trailers in 100-car trains at freight train speeds, there is a question as to how long a train they can safely handle at passenger car speeds. This is because slack tends to make the cars alternately run together and spread out, severely jerking rear-end cars.

"If passenger cars are to be handled simultaneously with flat cars it may be necessary to put the truck trailers at the rear and the passenger cars at the front. Flat cars don't have steam and electric lines for car heating, air-conditioning, lighting".

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[4]This USDA report offers some suggestions for truck-trailer manufacturers: "For easier servicing while still on the flatcar, piggyback trailers should have somewhat larger gas tanks. Most trailers now in use cannot hold enough gas to keep the refrigeration units going throughout the entire trip. Bigger tanks–of about 100-gallon capacity or two 50-gallon tanks–would save the time and labor now required for refilling enroute.

"Moving the temperature gage from the nose of the trailer to the side would also save a little in time and labor. As it is, crewman checking the load have to climb up into a one-foot space between the two trailers on the flatcar to read the temperature gage. This is inconvenient and a safety hazard. Temperature gages and controls mounted on the side of the trailer would make it a lot easier for temperature checks".

[5]Thermostatic Control For Fresh Perishables in Ice-Refrigerated Railroad Cars, INDUSTRIAL REFRIGERATION, Nov. '57, Pg. 15.

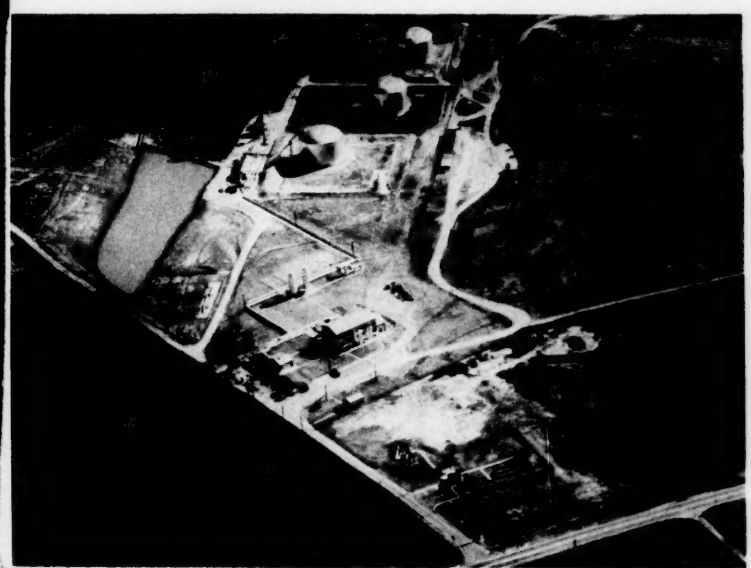
[6]USDA Publishes Test Results On Eleven Car Trans-US Lettuce Lift, INDUSTRIAL REFRIGERATION, Oct. 1958, Page 28.

PROPANE REFRIGERATES PROPANE FOR UTILITY RESERVE STORAGE

Unique Storage and Refrigeration System Employed At Atlanta To Meet Winter Peaks

This view across the Riverdale plant cooling water pond shows all three storage tanks with original tank on right. Refrigeration machinery is housed in shed in right foreground. Non-condensible purger, a feature of this plant, is vertical structure in front of left tank.

An aerial view of Atlanta Gas Light Company's recently expanded peak shaving plant near Atlanta shows in the background the two added refrigerated storage tanks, each holding 1,297,500 gallons. This was part of a $1,750,000 peak shaving expansion completed by the company last Fall. In addition to a seventy-five percent increase in storage capacity, production facilities were enlarged. The expansion included plants in Macon, Augusta and Rome, as well as those in Atlanta.



▶▶▶ REFRIGERATED STORAGE of liquid propane at minus 46 F helps the Atlanta Gas Light Co. over winter peak demands on its natural gas service. Considered novel in 1956 when the first insulated and refrigerated tank was erected by Stone and Webster Engineering Corp., Boston, the "peak shaving" system has proven practical enough that Atlanta Gas Light Co. added two more 1,297,500-gal propane storages in 1958.

Approximately 50 communities in Georgia are served with natural gas by this firm. As would be expected, Atlanta and its suburbs are the largest consumers. Residential heating, rather than industrial uses, skyrocket peak per day demands in excess of 500 million cu. ft.

Peak shaving, a term used by utility gas men to denote methods of meeting abnormal capacity requirements, has in the past been met with reserve propane stored in pressure tanks above or below ground. The propane has been reduced in pressure, had high pressure air added, and then was introduced into the send out system with natural gas from pipe lines to bolster normal supply.

Converting propane from liquid to vapor to propane–air gas for introducing into utility gas service lines, involves such extra equipment as heaters and vaporizers, and a refrigerating system to keep the propane liquid when resting in the storage. However, a saving is accomplished through the use of only one refrigerated LP storage to the customary 48 pressure vessels for the same conventional reserve.

The Gas Co. chose pioneering. They decided on a refrigerated storage and sought approval of the state fire marshall and other authorities. By locating the plant remotely and providing burn-off facilities for accidents, approval was granted.

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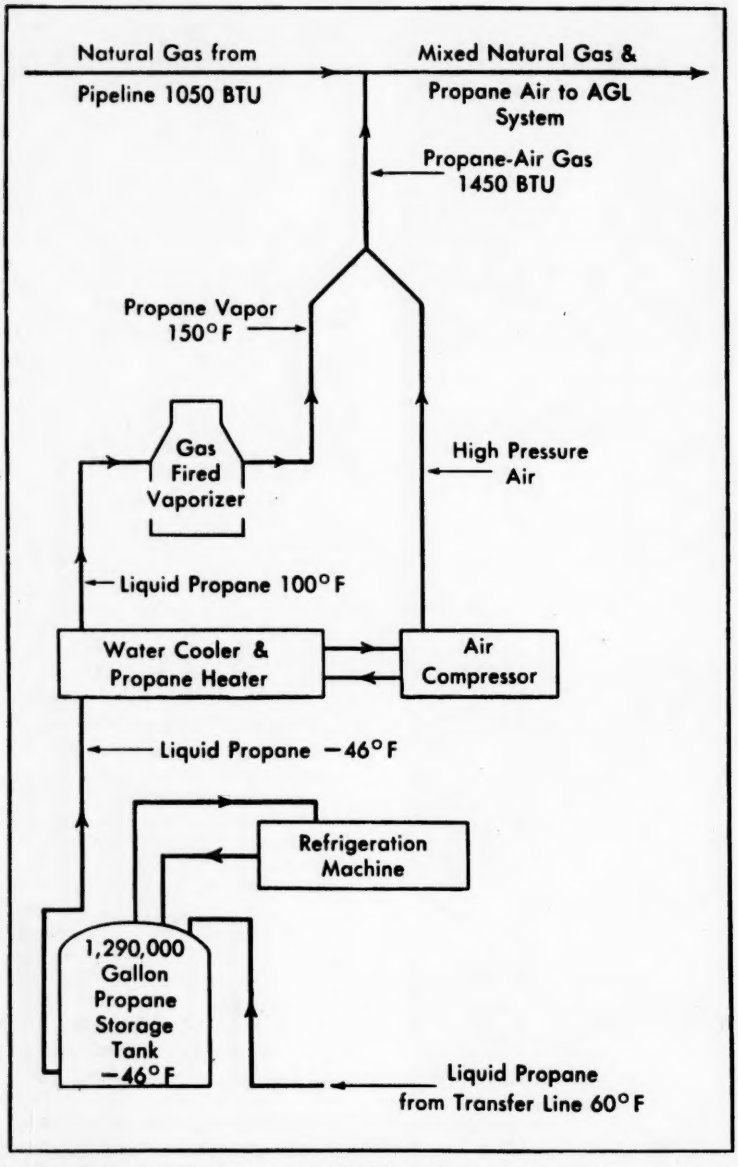
REFRIGERATED PROPANE STORAGE PROVIDES WINTER PEAK SHAVING

First Such Propane Storage

Twelve miles south of Atlanta, the Atlanta Gas Light Co. located the nation's first peak shaving storage plant of its kind.[1] The line schematic shows original equipment and system or peak shaving operations at this, the Gas Co's., Riverdale plant, constructed in 1956. Provision was made for doubling capacity, but the 1958 expansion at Riverdale saw the installation of two more refrigerated tanks of equal capacity.

According to B. C. White, Stone and Webster project engineer, the system is designed for receiving liquid propane at a 10-car rail siding in Jonesboro, five miles East of Riverdale. Unloading is to two pressure tanks from which the LP is transferred continuously through a 3-in. transmission line to the Riverdale refrigerated storages. Compressors at Jonesboro maintain pressure differentials which accomplish the tank car unloading and liquid transmission to Riverdale.


Natural Gas from Pipeline 1050 BTU
Mixed Natural Gas & Propane Air to AGL System
Propane-Air Gas 1450 BTU
Propane Vapor 150° F
Gas Fired Vaporizer
High Pressure Air
Liquid Propane 100° F
Water Cooler & Propane Heater
Air Compressor
Liquid Propane −46° F
Refrigeration Machine
1,290,000 Gallon Propane Storage Tank −46° F
Liquid Propane from Transfer Line 60° F

Schematic by B. C. White, is a simplified flow drawing showing how propane is stored, vaporized, mixed with air and sent into gas service.

Flashing Liquid Cools Self During Filling Operation

"During the filling operation", White wrote in GAS, April 1957, propane is introduced at the top of the tank through a flow control valve. A large portion of the liquid introduced at this point flashes to vapor, which is returned to the suction of the compressor. A second and larger compressor, driven by a 150-hp gas engine, is arranged to cut in and is sized to handle a propane filling rate of 25 gpm under summer conditions. This larger unit also serves as a standby compressor for the smaller one. The vapors from this larger compressor are combined with those of the normal refrigeration compressor for condensation in the air-cooled unit".

Refrigeration Control By Pressure Actuated System

James H. Tate, Atlanta Gas Light Co., advised INDUSTRIAL REFRIGERATION that the same refrigeration system is used for maintaining the low temperature as is used for chilling the propane during filling. "After the tank is filled, a compressor having 1/4 of the total horsepower is placed on automatic control of a pressure switch and by intermittent operation maintains the tank pressure between 0.5 and 1.0 psig. The resulting tank temperature (approximately minus 46 F) is determined by the saturation temperature of the product at this pressure."

Compound Compression— Direct Expansion System

Director Tate also explained, "The refrigeration process used at our Riverdale Plant is a simple expansion type of system with expansion and compression being in two stages. The second stage of compression is to 275 psig maximum, with compressed vapors being condensed in an air cooled condenser.

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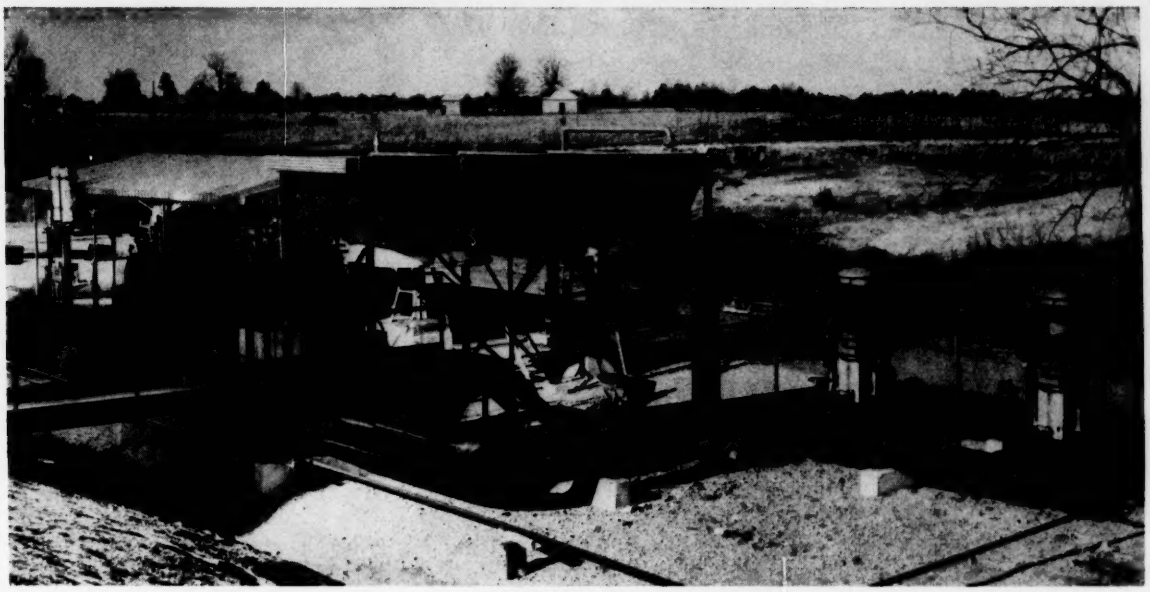
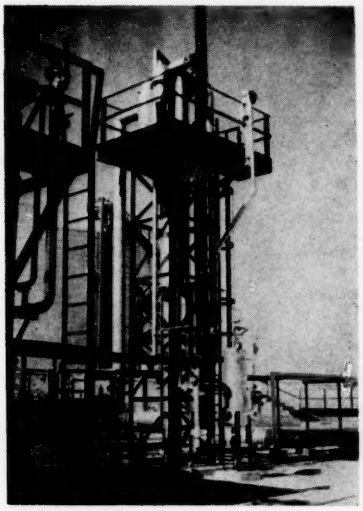
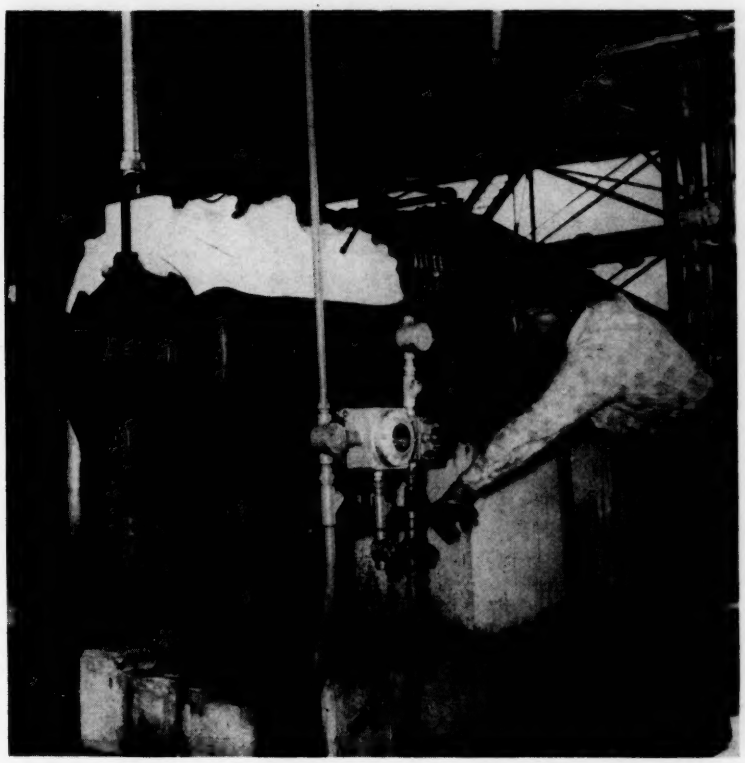
[1]A plant which liquefies and stores natural gas (which is chiefly methane) was built in 1940 for the East Ohio Gas Company at Cleveland, Ohio and stores about 6,000,000 lbs of liquefied gas at −250 F and at atmospheric pressure. This required 3 spherical tanks each 57-ft diameter inside of a tank 63 ft diameter with three feet of cork in between. Each tank when 80 percent full of liquid held about 2,000,000 lbs. It would have required tank space at least 535 times as great to hold the same weight of gas at atmospheric pressure and 80 F.—See *Operating Methods and Problems at Very Low Temperatures*, by the late Professor H. G. Venemann, 1948 NAPRE OPERATING DATA BOOK.



The refrigeration machinery is seen here from atop the dike surrounding a storage tank. Structure in center of photograph houses two horizontal condensers. Fans force air thru these condensers which carry propane vapor. It is in this operation that heat from storage tank and compression is removed, and the vapor liquefied before returning to storage.



In this view of the non-condensible vapor purger can be seen, tower, consisting of fractionator and reflex condenser; at lower left, reboiler.



Symbolizing the pioneering of refrigerated storage of propane, the compressor in the refrigeration shed at Riverdale wears a white ice cap. The refrigeration cycle begins with the removal of propane vapor from the tank at ½-lb pressure. It is liquefied under 200-psi by the removal of heat. When the LP is returned to the low pressure tank through the back pressure valve, it "flashes" or vaporizes, absorbing heat in the process, thus cooling the tank. Refrigerating engineers will note the liquid injection nozzles in the inlet valves of the compressor, and observe static electric grounding measures employed.

Refrigerant 290

"The first stage of compression as well as expansion is at 50 psig with liquid temperature of minus 20 F and vapors going to the compressor interstage. The last stage of expansion is directly into the storage tank at 0.5 psig pressure and minus 50 F temperature. The propane itself is the refrigerant ($CH_3CH_2CH_3$)."

(More on Page 18.)

Pictured here is the start of the LP Gas storage vessel. Eight inches of cellular glass blocks insulated floor of tank. Compressive strength of insulation enabled it to carry weight of tank contents.

Tank in foreground has been enclosed by free-standing cylinder of insulation. Two layers of blocks were used for a seven inch thickness. Stability of insulating material permitted its use as a free-standing wall to the 52-ft tank height.

Air Condensers

"No heat exchanger is required except the one air cooled condenser", Tate said. "The air-cooled condenser has two fans, each driven by a 15-hp motor", White noted. "One of these fans is arranged to start when the 50-hp compressor begins operation, and the other fan is set into motion when the large filling compressor becomes loaded.

"The liquid propane, condensed under these conditions, is returned to the top of the tank where it is expanded at a pressure control valve which maintains the back pressure on the compressor. In this valve, the propane liquid is reduced in pressure and temperature to the storage conditions, in the tank with approximately 50 percent of the liquid flashing to vapor. The vapor is recycled to the system for further refrigeration.

Purger Important

Purging is recognized by the competent refrigeration engineer and the economy minded owner alike, as an essential and continuous operation in an efficient plant. It is no different in a utility-gas peak shaving plant. Tate informed IR, "A major factor in the success of this system is the purger that is used to separate the non-condensible gases from the commercial propane, which results in a product in the tank having lower vapor pressure than commercial propane."

Flare-gas Safety Feature

"Non-condensible gases are withdrawn from the top of this accumulator and returned to the fuel gas system for use in the pilot lights provided around the dike and in the water heater," said White. Thus little waste occurs.

Insulation A Feature

Insulation played a major role in the construction and in the continuing operation of the Riverdale plant. Atlanta Gas Light and Stone & Webster settled on refrigerated storage in order to liquify the gas and save the high equipment costs of pressure storage. By so doing, they cut their tank costs by one-third, but one of the problems they faced in this unique installation was how to insulate the huge tanks.

Tank Contraction Posed Insulation Headache

Insulation on a refrigerated structure the size of this tank cannot be fastened directly to the vessel. When the tank is pulled down to its minus 46 F operating temperature, the contraction of the cylinder would pull tank walls away from the insulation. The solution was to construct a free standing wall which would form a concentric cylinder to the steel.

Secondly, the insulation should not only be impervious to vapor and moisture so there would be no condensation or freezing between the insulation and the tank, but insofar as possible the insulation should have no capillary contraction; that is, should not be capable of absorbing hydrocarbons which would constitute a fire hazard.

Supports Tank Weight

To solve this problem Stone & Webster chose cellular glass insulation produced by Pittsburgh Corning Corp. Eight inches of insulation material (Foamglas) was laid over the ground on which the tank rests. The application was made in two 4-inch layers and the floor of the tank rests directly on the material which supports the weight of the tank and contents.

Wall To Roof Closure Required Special Joint

Foamglas blocks in two layer construction were erected for the wall insulation. One layer was 4-inch and the second, 3-inch thick. The free standing wall is separated from the tank by only a small air space.

Seven inches of the insulation was also used on the roof or dome of the tank. A special flashing or expansion joint was provided between the free-standing insulation walls and the dome insulation. Roof and walls were sheathed with aluminum to provide an all-weather and reflective coating.

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Close-up illustrates how insulating wall of cellular glass is separated from tank by half-inch air space. Hence, when tank contracts during refrigeration, insulation is unaffected.

Like standing on top of the world, this workman applies a second layer of the cellular glass insulation.

Because the walls are free standing and the dome insulation applied to the tank, a special expansion joint was required at the roof-wall juncture. The juncture was made with asphalt impregnated vapor barrier. Aluminum sheeting is applied over the dome and to the exterior of the wall insulation for a reflective finish coat.

Steel Saving Measure

The principal advantage of the refrigerated storages is economical use of steel. Each is 70 feet in diameter, 52 ft high and holds 1,297,500 gallons of propane. To provide this storage in pressure tanks would have required some 48 tanks weighing over 1800 tons. Installed cost of the first tank, including the associated refrigeration equipment, was about $550,000. Pressure tanks with the same capacity cost about $1,130,000.

JORDAN HEADS U.S. DELEGATION TO IIR CONGRESS AT COPENHAGEN

▶▶▶EARLY IN JULY, Dr. Detlev W. Bronk, President of the National Academy of Sciences–National Research Council, announced the appointment of six delegates to the 10th International Congress of the International Institute of Refrigeration meeting in Copenhagen, Denmark, from 19-26 August, this year. The delegates, all members of the U. S. National Committee for the International Institute of Refrigeration, are: Dr. R. C. Jordan, Head, Department of Mechanical Engineering, University of Minnesota; Mr. J. E. Dube, President, Alco Valve Company; Mr. W. T. Pentzer, Chief, Biological Sciences Branch, Marketing Research Division, Agricultural Marketing Service, U. S. Department of Agriculture; Dr. F. G. Brickwedde, Dean, College of Chemistry and Physics, Pennsylvania State University; Dr. C. F. Kayan, Executive Officer, Mechanical Engineering Department, Columbia University; and Mr. B. H. Jennings, Director, Research Laboratory, American Society of Heating, Refrigerating and Air-Conditioning Engineers.

The membership of the U. S. National Committee, consisting of twenty individuals selected from academic, governmental, and industrial institutions, is appointed by the President of the National Academy of Sciences to effect participation for the Academy as a "national member" of the International Institute of Refrigeration. The chairman of the U. S. National Committee is Dr. R. C. Jordan; Mr. John E. Dube is the vice-chairman, and Mr. W. T. Pentzer is the secretary.

Standards Activity

Of particular importance to U. S. industry is the Institute's work in international standards. It has its own standards program and also cooperates actively in the establishment of refrigeration standards of the International Standards Organization (ISO). Over the past year the work of the U. S. National Committee has been closely followed and supported by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, the Air-Conditioning and Refrigeration Institute, and the Refrigeration Research Foundation.

Canadian Representatives

W. R. Phillips, cold storage expert with the Plant Research Institute, Canada Department of Agriculture, will also attend the Congress at Copenhagen. In all, nine Canadians will attend. Mr. Phillips will present two papers. One deals with the possibilities of jacketed storage and tells of commercial tests started at Picton, Ont., last summer.

Industry Supported Venture

It is significant that the U. S. National Committee for the International Institute of Refrigeration receives its financial support through contributions from industry, associations, and individuals who feel that this international activity is of benefit both to the United States and the entire world. Organizations contributing to the support of the U. S. National Committee receive the Committee annual activity report as well as the assurance that there will be appropriate national representation at the engineering-scientific level for the many international aspects of refrigeration. This is particularly important in the area of international standards which may have an effect on the competitive aspects of the products of American industry.

A typical example of the activities in the International Institute of Refrigeration is demonstrated by the work in Commission IV. U. S. members on that Commission have been assisting in the development of Commission recommendations on acceptable storage temperatures for foods of all kinds. These recommendations may provide a basis for international agreement on temperature requirements that could affect food storage techniques and possibly influence legal decisions involving claims rising from storage and transportation losses.

Twenty-five U.S. Speakers

Plans for the 10th International Congress include the presentation of approximately 250 papers by speakers from many countries. Indications are that about twenty-five papers will be contributed and delivered by speakers from the United States.

The International Institute of Refrigeration was founded in Paris, October, 1908. There are presently thirty-five countries in its membership; individuals may be associate members with equal opportunity to serve on the various Commissions. The Institute publishes a Bulletin six times yearly; this publication, which goes to each member, summarizes world happenings in refrigeration and related fields. The abstracts, appearing both in English and French, provide a valuable source book for research and engineering staffs.

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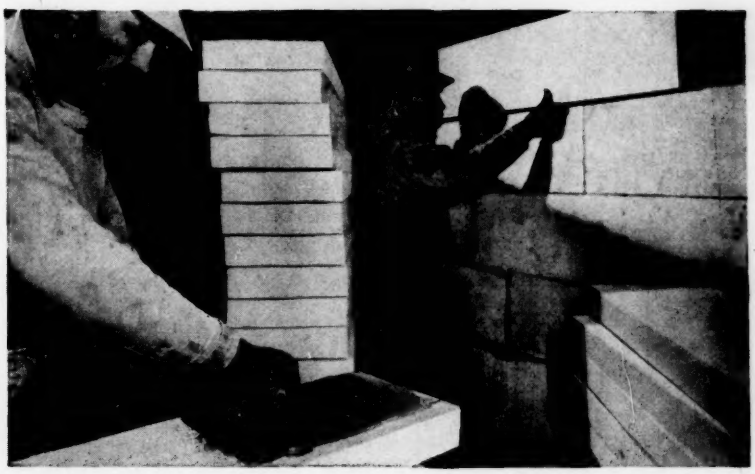

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—CONTROLLED ATMOSPHERE REFRIGERATED STORAGES—

- A Boon To Fruit Warehouses

By FRANK V. KEDENBURG, Jr.
Refrigeration Consultant and Contractor
Highland, New York

▶▶▶NEED FOR an efficient, long-term fruit storage system has brought about the ascendancy of the controlled atmosphere refrigeration system over the past few years. Cold storage companies, faced with the problem of holding fruits and vegetables for long periods of time, are turning more and more to this type of system. Reason: without control of the atmospheric conditions as well as the temperature in sealed storage rooms, spoilage cuts into profits seriously; often involves excessive operating and maintenance costs.

Atmospheric control is necessitated by the process of respiration carried on by the fruit in storage. During respiration, sugars are oxidized or burned in the presence of oxygen. Carbon dioxide, water vapor, and heat are the results of this process.

Respiration Upsets Normal Conditions

Fruit stored in a room with normal atmospheric conditions thus soon upsets the normal atmospheric make-up. Ordinarily, the atmosphere is composed of around 78 per cent nitrogen, 21 per cent oxygen and .03 per cent carbon dioxide.

The more rapid the respiration rate, the more rapidly the fruit deteriorates. This rate can be slowed in several ways:

1) lowering the temperature
2) reducing the amount of oxygen available to the fruit
3) increasing the amount of carbon dioxide surrounding the fruit.

However, the amounts of oxygen and carbon dioxide must be kept at definite levels for maximum fruit life. Experience has shown that MacIntosh apples, for instance, require an atmosphere with 2 to 3 per cent oxygen, 5 per cent carbon dioxide. Thus, the job that the system must do is allow the oxygen content to be lowered through fruit respiration to the desired level, and then hold it there by introducing small amounts of fresh air into the room from the outside as needed. Likewise, the carbon dioxide content is allowed to rise to the desired level. Then anything over that is removed.

Historical Background

Controlled atmosphere storage was originally developed in England by Kidd and West. These two men devised a system that controlled the carbon dioxide and oxygen content within the storage space without refrigeration. Even without temperature control, they succeeded in prolonging the life of fruit under storage, and during its later shelf life.

Further development was done by Professor R. M. Smock of Cornell University, who combined the two types of control. By using existing refrigeration systems in cold storage rooms and installing atmospheric control devices, he was able to refine the English system.

Early controlled atmosphere systems used an air scrubber, called a "barrel scrubber." It was a huge tank built like a barrel (See Fig. 1), with a reservoir in the bottom, and baffle plates mounted in the top. The reservoir contained a caustic soda lye solution. A pump drew the solution from the reservoir and pumped it to the top of the barrel. As the solution dripped down through the plates back to the reservoir, air from the cold room was circulated through the solution, giving off carbon dioxide as it passed through. The air was then returned to the refrigerated space.

Although the barrel scrubber was successful, it was limited. Only 5000 to 8000 bushel capacity rooms could be accommodated by this type system. The reason was that only small amounts of air could be removed from the room, and the entire scrubber was too large and cumbersome because of the need for the reservoir.

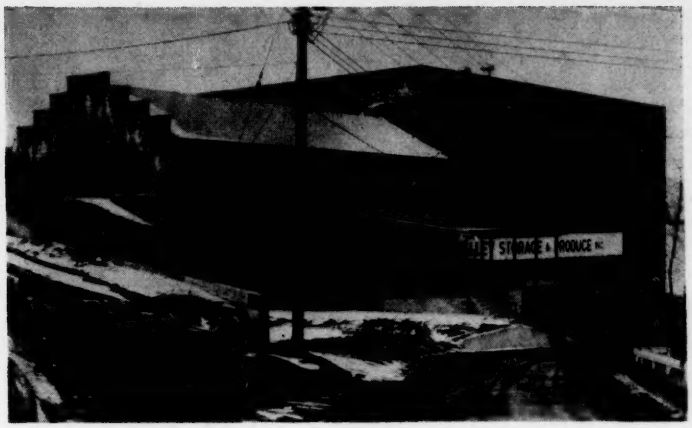
Other disadvantages were inherent in the barrel scrubber systems. The caustic soda lye solution consumption was high—from 40 to 80 lbs/day. Extra humidifying nozzles had to be installed in the storage space to maintain humidity. However, the system was a step in the right direction.

Spray Washer Developed

In 1948, a new type of scrubber called the spray washer was designed by Frank Kedenburg. To test it, an experimental 15,000 bushel capacity cold room was built at Stanley Orchards, Modena, New York. Immediately successful, the experiment led to a rapid growth of controlled atmosphere systems.

The spray washer is designed around a brine spray cold diffuser. A storage tank for water is located outside the cold room. The cold diffuser, with refrigerant in the coils to maintain constant temperatures, is equipped with a spray header to circulate the solution over the coils.

A fan section circulates all the air from the refrigerated space over the spray. When the refrigeration system is not operating, the spray system



View of Valley Storage and Produce Co., Germantown, N.Y. shows loading area, dock, and equipment storage. Four controlled storages were installed here in 1958.

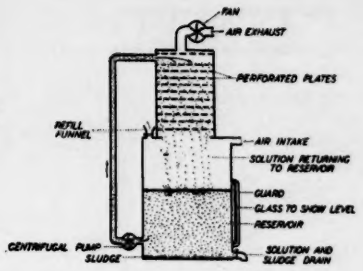


Fig. 1. Old barrel scrubber was used in early systems. Large and cumbersome, it did not permit washing of all air in a cold room, thus was limited in the room size it could serve. Consumption of absorbing solution was high.

continues to operate, acting not only as a carbon dioxide absorber, but as a spray humidifier. Thus, room size can be increased without danger of lowering the humidity.

The system also uses less caustic or lye solution. Only about 20 to 30 lbs/day are required.

In the spray system, the solution is taken from a disorber tank and pumped to a temperature absorber unit (as shown in Fig. 2). Spray nozzles are located in the top of this unit, and spray the solution downward over refrigerant-carrying coils. Air from the cold room is pumped through the spray, gives off its carbon dioxide, and returns to the cold room.

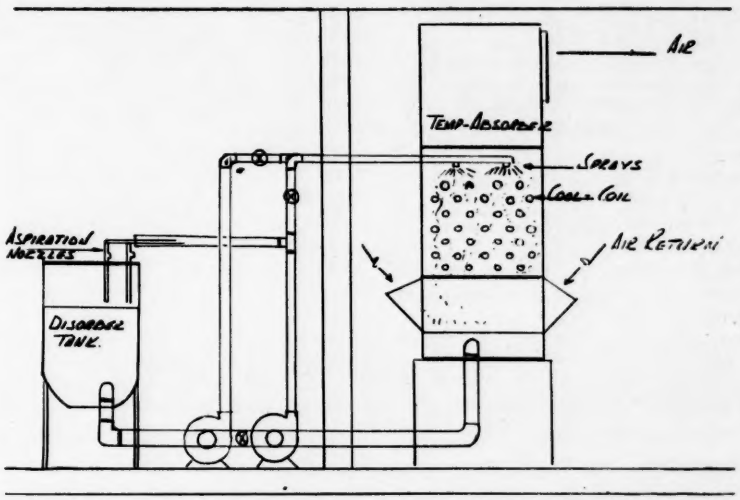


Fig. 2. Newer type of air washer is the spray system. Temperature absorber is located in the cold room, disorber tank outside. All air in the cold room is circulated through the unit, enabling it to handle larger rooms. Coils are refrigerated. Spray nozzles also provide humidification when refrigeration is not in operation.

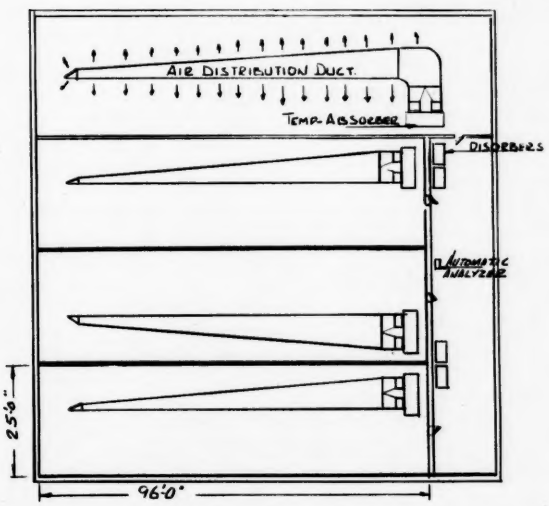


Fig. 3. Plan view, Valley Storage, shows location of disorber, analyzer, and temperature absorbers. This particular installation uses no caustic solution; depends on water to absorb excess CO_2.

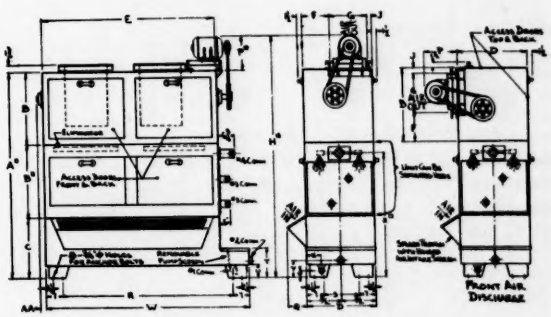


Fig. 4. *Krack* brine spray units for use in controlled atmosphere systems. Engineered to last, they form the heart of a controlled atmosphere system, providing carbon dioxide removal, temperature control, humidity control.

Water Serves As Absorber

Latest systems use the same type of arrangement, but without a caustic or lye solution. These systems use water alone and carbon dioxide absorption is made possible by a specially-built brine spray unit.

A good example of this type is located at Valley Storage and Produce Company in Germantown, New York. This installation, completed in 1958, is used for the preservation of both MacIntosh and Delicious apples. An atmosphere of 5 per cent carbon dioxide and 3 per cent oxgen is maintained on the former, 3 per cent carbon dioxide and 3 per cent oxygen on the latter. Temperatures are held at 38° and 32°F, respectively.

Valley Storage maintain four apple rooms, each measuring 25 x 96 x 12 feet, each with a capacity of 12,000 bushels (pictured in Fig. 3). Installed in each room is a "Krack" floor mounted, low temperature, brine spray Freon 12 absorber unit (as shown in Fig. 4). Temperature, humidity, and carbon dioxide control are all maintained by these units, which are manufactured by Refrigeration Appliances, Inc., Chicago.

The process of absorption-disorption is accomplished by spraying water over the refrigerated coils of the absorber unit by means of a circulating pump. As air passes through the spray, water absorbs carbon dioxide.

Water Disorber Explained

The water is then pumped to the disorber unit outside the cold room and returned to the storage tank through a series of specially designed venturi type nozzles. Fresh air induced into the water stream absorbs the dioxide from the water. The water is then recirculated to the absorber unit in the refrigerated room. With this arrangement, no caustic solution is needed.

Sampling Control Adapted

An automatic analyzer is built into this system for completely automatic control. This unit was built by the Cambridge Instrument Co., Ossining, New York, and adapted to controlled atmosphere use by the author. It reads and records the carbon dioxide content and oxygen content in each room for 30 minutes every two hours Operation is continuous.

Until 1948, it was necessary to install extremely elaborate equipment for long-term storage, due to the need to control so many factors. With the development of the controlled atmosphere and the refinement of available equipment such as the "Krack" line of brine spray units, this is no longer necessary. These units provide two of the important ingredients of the system: sufficient coil surface to permit the water to absorb the carbon dioxide, close temperature control.

Economic Justification

Controlled atmosphere storage systems will pay for themselves over a period of time by cutting spoilage. Common storage disorders such as brown core and core flush are virtually eliminated. By holding the carbon dioxide content of cold room atmosphere at the proper level, the danger of carbon dioxide scars occurring to fruit are eliminated.

Fruit can be removed from storage with full assurance of prime eating quality, **even after periods as long as two years.** Texture and appearance are retained at tree-like quality.

The benefits of the system are ultimately passed on to the grocer and the consumer. After storage under controlled atmosphere conditions, the fruit can be marketed with increased shelf life at room temperature.

Already, controlled atmosphere storage has replaced many straight refrigeration systems. Growers and wholesalers alike will probably turn more and more to this type of system, since it enables them to hold fruit until market conditions are favorable, then sell at better and more consistent prices. Controlled atmosphere systems will constitute the major portion of future fruit storage installations.

Heat Pumps Add Another Air To Air Application

▶▶SPRINGFIELD, ILL. will be the location for two factory assembled heat pumps said to be the first used in a major municipal building. Public Building Commission, Springfield, the State Capitol, recently contracted with York Div., Borg-Warner Corp. for a year round air conditioning system in the new 3-story municipal building scheduled for completion late in 1960.

Two identical factory assembled packages utilizing the compound compression air source heat pump will provide simultaneous heating and cooling for different zones within the building as may be required in the various seasons of the year.

Heating or cooling will be controlled by thermostats which will automatically switch the heat pump operation as required. Individual areas around the building perimeter will be conditioned by fan coil units permitting local adjustment by occupants. Central multi-zone units will condition the building's interior.

An Underground For Water Chillers

▶▶GULF Research & Development Co., thinks well enough of their research center and campus-like atmosphere that they will go to considerable extent to dress up, conceal or otherwise hide machinery, buildings or equipment shapes which might detract from the plant operations. Two new absorption refrigeration machines will be placed in an underground vault and covered over with landscaping at Harmarville, Pennsylvania. The centrally located refrigerated plant will provide chilled water for controlling climate in parts of five major laboratory buildings and several smaller structures.

Carrier absorption machines are employed, rated at 236-TR each. Chilled water is piped through subterranean passages which are also used by Gulf personnel as all weather walk-ways. The installation is the first major step in providing air conditioning for the entire research center which employs more than 1500 persons. Systems for the Research & Development Center require special consideration or design. For example, fumes generated in various laboratory experiments with petroleum products, often requires high volume exhaust to evacuate these obnoxious gases.

In July 1958 INDUSTRIAL REFRIGERATION reported on the environment rooms at Harmarville, showing how refrigeration is used for automotive research (see pages 10-14). Three large test rooms, largest of which is capable of accommodating a "Scenicruiser" bus, employed refrigeration tonnages equal to the first increment of comfort air conditioning now to be installed. As in many installations, the industrial applications of refrigeration and air conditioning have led to comfort air conditioning.

Brewing Featured At Customers' Forum

▶▶ CUSTOMERS' VIEWPOINT is the theme of a series of Customers' Forums sponsored by York Div., Borg-Warner Corp. Second in the 1959 series was a session on the brewing industry. J. Artie Bowersox, director of engineering, National Brewing Co., Baltimore, addressed York engineering, sales and production personnel on history of the brewing industry.

Bowersox told his audience that refrigeration is one of the three most significant developments in the brewing art. He pointed out that the industry served as a development laboratory for artificial refrigeration as early as 1870, and the first patent pointing toward present concepts of air conditioning was issued in 1880 to a Richmond, Virginia brewmaster.

Outlines Beer Making Storage Requirements

Bowersox recommended that cellars be held at precisely 32 F pointing out that there is no advantage in lower temperatures. Air units with automatic defrosting are normally employed, he related, and air distribution is important to the people who work in those areas.

Hop storages received considerable attention from the speaker. He pointed out there is only one crop of hops available each year and shutdown of equipment could be serious. Subfreezing temperatures with gravity air circulation is preferred in this area, he stated. Yeast storage he also covered, indicating that pipe coils were preferred to air units due to the presence of spores.

Other suggestions included grouping of suction lines to operating machinery, built-in flexibility to meet extreme load variations common in breweries, and the consideration of steam turbines for compressor drives when expanding capacity.

Engineer Offers Wise Sales Counseling

Bowersox also offered some advice to refrigeration sales engineers. He counselled them to be aware of changing patterns in the brewing industry. Sales of equipment, he related, while not frequent are likely to be larger. Sales engineers are looked on as advisers and he recommended that they should pay attention to details of brewery operation, make regular courtesy calls and submit sound recommendations when indicated. "When business is available", Bowersox said, "it will go to the company whose sales engineer has best followed this pattern in looking out for the brewery's interest."

Brewery Refrigeration Needs

Using as an example a brewery which produces 10 million barrels annually, Bowersox indicated such a plant would require 1200 to 1500 TR daily, a portion of which is reserve capacity. Discounting the reserve he broke down the brewery needs as follows:

Wort Cooling	30%
Beer Cooling	15%
Fermentation	15%
Storage Cellars	25%
Office Air Conditioning	15%

Needs Detailed

Automatic and accurate temperature control for wort cooling is a must according to Bowersox. Since character of a beer depends on the manner in which the wort is cooled, the speaker advised his industry listeners not to prevail on brewmasters to use different types of coolers.

Two other important suggestions were made with regard to fermentation process. One was the close degree of hand-control which should be allowed the brewmaster so that his experience and judgment can be used to the greatest extent. The other was practical in nature, pointing out the importance of coil design with regard to thoroughness of cleaning.

The first York Customers' Forum heard Arnold D. Spillman, from the Sales Application Department of Philadelphia Electric Co. discuss the economics of two large heat pumps.

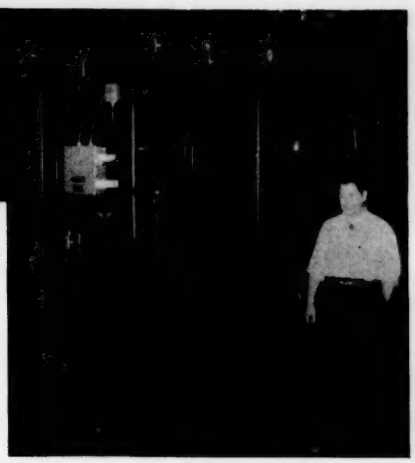
Kingsbury Buys Sioux City Brewery

▶▶ IOWA'S LARGEST brewery, Sioux City Brewing Company was purchased recently by Kingsbury Breweries Company, according to announcement by O. H. Cole, at Milwaukee. The Kingsbury firm has breweries at Manitowoc and Sheboygan, Wisconsin.

Brewers To Hear Herzog

▶▶ MASTER BREWERS Assn. of America will learn what an engineer can contribute to their brewing efficiency, when John H. Herzog addresses their national meeting at Cleveland in September. Herzog, chief engineer of Buergermeister Brewing Co., San Francisco authored "Refrigerating Plant Safety & Accident Prevention" INDUSTRIAL REFRIGERATION, June '59, page 28.

THE ULTIMATE IN THE COMPRESSION REFRIGERATION CYCLE*



THIS IS ANOTHER CYCLE CENTER, factory assembled and on its way to a 150 ton poultry freezing plant.

What will it do?*

It will provide liquid overfeed to the evaporators, catch the excess liquid and recirculate it to the evaporators, with these results:

- FULL COMPRESSOR PROTECTION AGAINST SLUGS
- PEAK COIL AND COMPRESSOR EFFICIENCIES
- SUB COOLED LIQUID FEED AT CONSTANT PRESSURE THE YEAR AROUND
- PRACTICALLY UNLIMITED RATE OF LIQUID FEED AT ABSOLUTELY NO POWER COST
- NO MECHANICAL PUMPS
- NO FLASH GAS IN LIQUID LINES
- SAFE, AUTOMATIC PLANT OPERATION
- OIL SEPARATION, ANY REFRIGERANT
- HIGHER SUCTION PRESSURES
- LARGE POWER SAVINGS
- LARGE SAVINGS IN FIRST COST ON NEW PLANTS. FOR EXAMPLE, THE RECEIVER IS NOT REQUIRED AND SURGE DRUMS ARE ELIMINATED.
- AUTOMATIC HOT GAS DEFROSTING AT MINIMUM COST

ASK FOR BULLETIN CC-2

*** NOT JUST A LIQUID RETURN UNIT.** Available for any refrigerant, in capacities from 10 to 1,000 tons and more. Factory assembly is optional.

J. E. Watkins Co.
307 LAKE STREET, MAYWOOD, ILLINOIS

Nineteenth meat packer or meat products processor for Omaha is this beef plant opened early in 1958.

Nebr-Iowa president Jerry Volcek and treasurer Sternad inspect chilled sections awaiting transit.

Photos Courtesy of US Sno-Man

Nebraska-Iowa Beef Co. Newest Omaha Food Plant

▶▶OMAHA, NEBRASKA continues to grow as a food center. Earlier in the year that area acquired its 19th packing plant with a start of operations at the Nebraska-Iowa Dressed Beef Co. Production capacity of the new plant is 150 head per day.

Designed for expansion to four slaughter beds, the plant is also adaptable to Kosher slaughter. Located in the Stock Yards district, the plant is serviced by the C.B.&Q.RR and will purchase cattle on the Omaha market. Officers of the company are Jerry S. Volcek, president, Francis J. Murphy and Eugene A. Giermann, vice-presidents, Thomas F. Burke, secretary and Joseph T. Sternad, treasurer. The plant employs some 25 workers under Federal Inspection.

Meat Packing Plant For Rocky Mountains

▶▶CAPABLE of slaughtering and dressing 600 cattle and 2400 sheep daily, a $2 million meat processing and packing facility was started in Greeley, Colorado on May 15. The 2-story plant is being built by the Capitol Packing Co. of Denver and Montfort Feed Lots, Inc. of Greeley. The new firm will be known as the Greeley Capitol Packing, Inc.

Chilling and storage facilities for 1250 beef and 3000 sheep will be included in the plant. The Union Pacific Railroad will serve the installation which will be capable of loading 20 cars of dressed animals per day. Edible by-products will be processed and packaged at the plant in addition to the slaughtering phase. Other non-edible production phases include some animal hide processing, production of tallows and poultry feeds.

Contracts for refrigeration and packing house equipment have not been let. However, the mechanical contract went to a Denver firm with the general construction being awarded to a Greeley contractor. The Capitol firm is also extending their Denver plant as part of a general expansion program.

Large Meat Packers Decentralizing

▶TWO MORE of the nation's largest packers announced discontinuance of live stock operations in Chicago in June. Swift & Co. announced in mid-May that the Chicago plant would discontinue cattle dressing and beef operations in mid-June.

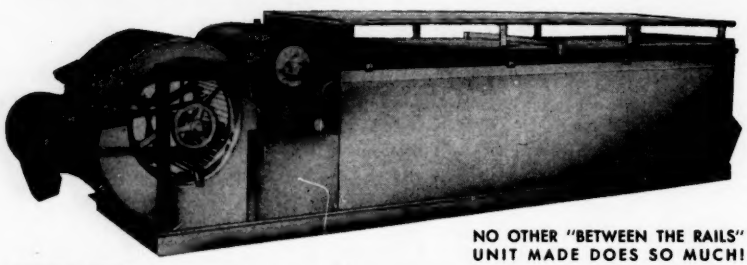
According to Walter F. Schuette, Chicago plant manager, continuing company studies revealed that it was no longer economical to continue certain packing activities in large central plants like Chicago. Swift & Co. has in the past few years built a number of smaller slaughtering establishments in various U. S. regions.

Armour Drops Six Plants

At Chicago in June, Armour & Co. discontinued live stock slaughtering operations, like Swift & Co. However, they also discontinued some slaughtering operations at Fort Worth, Texas, East St. Louis, Ill., West Fargo, N. Dak., Tiffin, Ga. and Columbus, Ohio.

Armour management indicated that operations have been conducted at a loss, resulting in this curtailment. Wilson & Co. discontinued their Chicago operations nearly two years in advance of the Swift and Armour curtailments.

CHILLJET FOR CARCASS CHILL ROOMS



NO OTHER "BETWEEN THE RAILS" UNIT MADE DOES SO MUCH!

CHILLJET affords the quickest, most effective chilling process with minimum shrinkage!

AUTOMATIC DEFROST

Available with automatic hot gas defrost or water defrost.

Learn how Chilljet can save you money.

Write to:

Imeco Incorporated

CHILLJET CHILLS BEST

- Minimum shrinkage assured by generous coil surface which permits operation at a small temperature difference throughout the chilling period.
- Between the rails location, with two-way air distribution, assures rapid, uniform carcass chilling.
- Ceiling suspended, designed to fit between meat rails, it saves valuable floor space. Available for use with thermal valve, float feed or liquid recirculation.

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CHICAGO 18, ILLINOIS
JUniper 8—7117

Industry Meetings

International Refrigeration — **Aug. 19-26**
TENTH INTERNATIONAL CONGRESS OF REFRIGERATION
Copenhagen, Denmark

Cryogenics — **Sep. 2-4**
CRYOGENIC ENGINEERING CONFERENCE
University of California, Berkeley

Brewers Exposition — **Sep. 20-25**
MASTER BREWERS ASSOCIATION OF AMERICA
INTERNATIONAL BREWING INDUSTRIES EXPOSITION
Public Auditorium, Cleveland

Instrumentation — **Sep. 21-25**
INSTRUMENT SOCIETY OF AMERICA
International Amphitheatre, Chicago

Meat Packing — **Sep. 25-29**
AMERICAN MEAT INSTITUTE
Palmer House, Chicago

Dairy Conventions — **Oct. 4-10**

DAIRY INDUSTRY SUPPLY ASSN.—Oct. 4-10
Saxony Hotel, Miami Beach
MILK INDUSTRY FOUNDATIONS—Oct. 5-7
Fontainebleau Hotel, Miami Beach
NATIONAL ASSN. OF ICE CREAM MFRS.—Oct. 7-9
Eden Roc Hotel, Miami Beach

Brewing Meet — **Oct. 18-20**
BREWERS ASSOCIATION OF AMERICA
Edgewater Beach Hotel, Chicago

Ice Manufacturing — **Oct. 20-24**
NATIONAL ICE ASSOCIATION
Sheraton-Dallas Hotel

Service Engineers — **Oct. 30-31, Nov. 1-2**
REFRIGERATION SERVICE ENGINEERS SOCIETY
Ambassador Hotel, Atlantic City, N. J.

Air-Cond'g & Refrig'n Exposition — **Nov. 2-5**
11TH EXPOSITION OF THE AIR-CONDITIONING AND REFRIGERATION INDUSTRY
Convention Hall, Atlantic City, N. J.

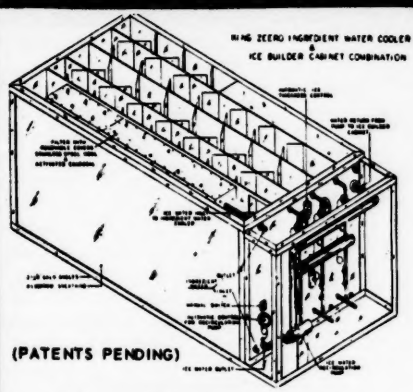
Ice Engineers — **Nov. 11-12**
SWIMA ANNUAL CONFERENCE OF ENGINEERS
Rice Hotel, Houston

Chemical Processing — **Nov. 30 - Dec. 4**
27TH EXPOSITION OF CHEMICAL INDUSTRIES
New York Coliseum

Safety Congress — **Oct. 19-22**
NATIONAL SAFETY COUNCIL
Various Chicago Hotels

Practical Refrigerating Engineers — **Dec. 9-11**
NATIONAL ASSOCIATION OF PRACTICAL REFRIGERATING ENGINEERS
Roosevelt Hotel, New Orleans

For Ideal Filtered Ingredient Water at Low Cost



(PATENTS PENDING)

- Cools water 34 degrees Fahrenheit.
- Filter removes all silt, algae and chlorine from city or well water supply.
- Pure water is chilled by ice water -- *prevents freeze-ups.*
- The ideal water for ingredient and wash water applications -- food processing needs, butter or cheese wash, dough water, poultry or produce chilling.

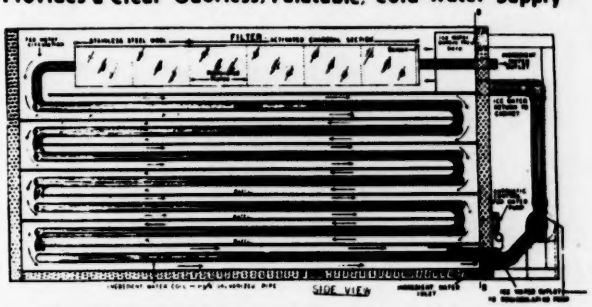
Available in Cabinet or Vertical Styles.

Write for Bulletin PWC 59.

Choose "King Zeero's" NEW

PURE WATER COOLER

Provides a Clear Odorless, Palatable, Cold Water Supply

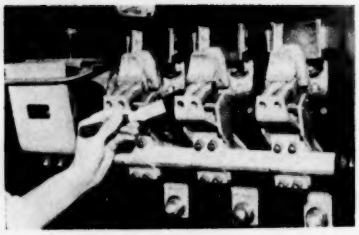


The KING ZEERO Pure Water Cooler consists of a galvanized pipe water coil, a self contained efficient charcoal filter, a KING ZEERO Ice Builder and an ice water recirculation pump, with controls and necessary valves for flow and back wash, all contained in an integral unit

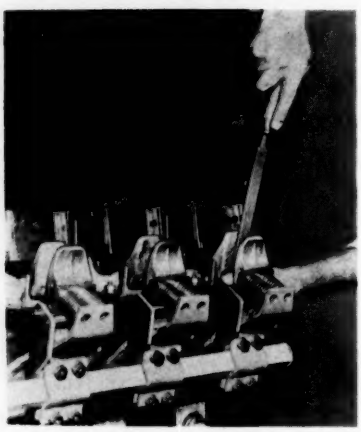
THE KING ZEERO COMPANY
4300-14 W. Montrose Ave.
Chicago 41, Ill.
Manufacturers of Ice Builders - Ice Builder Cabinets - Ice Banks - Pure Water Coolers

PRACTICAL ELECTRIC MAINTENANCE

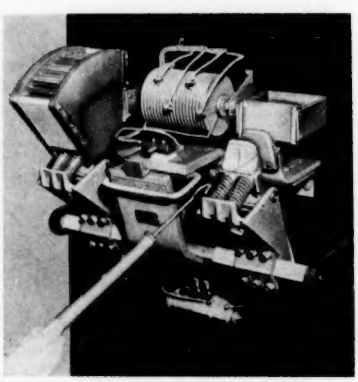
Here's How To Get The Most



Simplest items are often overlooked in electrical equipment maintenance. Dust, dirt and grease must be removed periodically from motor controllers. Dry dust may be blown or brushed off.



Although pitting of contacts does not affect their operation, deposits must be removed. When dressing contact tips, the original contact shape must be retained.



Initial spring tension should be checked with a scale in accordance with the manufacturer's recommendation. Final contact pressure should be checked at contact heel in a similar manner, except with the magnet in the closed position.

▶▶▶MOST ELECTRICAL CONTROL DEVICES, be it a motor starter, switch or integral control, **will give trouble-free service provided they** are properly applied, have an adequate electrical system, and **are correctly maintained.**

Since most control devices have moving parts, failure to recognize and correct early trouble symptoms can lead to a chain reaction which could result in disproportionate maintenance costs or in complete replacement.

Safety-First Emphasized Before Servicing Controls

Only skilled personnel familiar with electrical equipment and the hazards involved, should be permitted to service control units. All safety precautions should be observed, not only on the electrical equipment but on the driven machines as well. A periodic inspection schedule and precautionary maintenance program will have savings results in replacement parts and down time of machines.

Good Housekeeping Is Next Important To Safety

Dust, dirt and grease should be removed periodically from the controller. Dust can cause mechanical failure and it may form a path between points of different potential, resulting in a short circuit. Dry dust can be blown off; sticky dust and grease are best removed with commercial solvent. Care should be taken when using solvents so the coils do not become soaked.[1] Special attention also must be paid to rust and corrosion, particularly on thermal over-load relays.

Do Not Lubricate Control Board Components

Moving mechanical parts should be free from excess friction. The parts should be tried by hand to locate any loose pins, bolts, etc. Wearing parts should also be checked for excessive wear. The bearings on electrical control equipment are designed to operate without lubrication. If oiled or greased, dirt will accumulate and cause sluggish action and possible failure.

[1]See also, INDUSTRIAL REFRIGERATION, February 1959, page 14 "Safe Solvent for Motor Maintenance".

Sharp Eyes Detect Trouble Tips In Overheat

Overheated parts are always a sign of trouble. Since various parts operate at different temperatures, it may be difficult to locate this trouble. For example, coils, blow-out coils, and other parts of the contactor may operate at a temperature which would boil water, hence these parts cannot be touched. Any evidence of baking or smoking, however, should be cause of immediate attention.

Loose connections, always a source of trouble, may develop at any time. Therefore, control connections should be checked periodically along with the main line connections.

The best way to check for grounds which may develop is to *Megger*[2] the cables and conduits periodically. This is especially necessary if water could collect in the conduit.

Servicing Contact Points Requires Craftsmanship

Contactors need the most care. Their bearings should be checked for free operation but not lubricated. Deposits on contacts should be removed with either sand paper or a fine file. Never use emery paper because it imbeds in the contact face and continues to wear.

In filing, care should be taken to maintain the original shape of the contact, but don't overdo. While copper oxide should be removed because it is an insulator, trying to keep them smooth only wastes the material of the contact surface. Silver contacts should never be filed unless they become severely roughened. Silver oxide is a good conductor and does not need to be removed. When contacts are deeply pitted, burned, or worn thin, they should be replaced with new sets. Screws holding the contacts in place should be kept tight at all times.

[2]"Megger" is the registered trade-mark of Jas. G. Biddle Co. The reference here is to the use of a megohm-meter for measuring insulation resistance-to-ground of cable to conduit. "Vibro-test" portable ohm-meters of Associated Research, Inc., and other makes of industrial test meters may be used similarly. See "Electrical Maintenance of Switchgear, Starters, Motors in the Prevention of Refrigerating Plant Failures" by Regis Gubser, July 1956, INDUSTRIAL REFRIGERATION.

SURE-STARTS THOSE AUTO-SYSTEMS

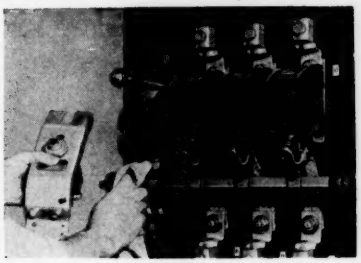
Out Of Control Devices

Maintain Spring Tension

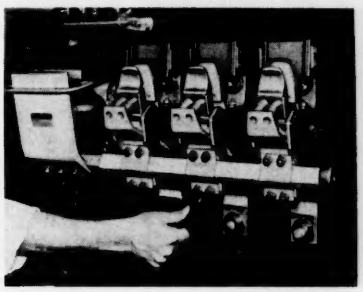
Springs maintain the proper contact pressure. If contacts are permitted to wear too thin, spring pressure decrease and overheating results. This generally causes the spring to lose its temper, further decreasing the contact pressure. Spring tension should be checked with a scale in accordance with the manufacturer's recommendation.

If a scale is not available, a comparison test could be made between the installed spring and a new one of the same design. Where neither of these tests is possible, springs may

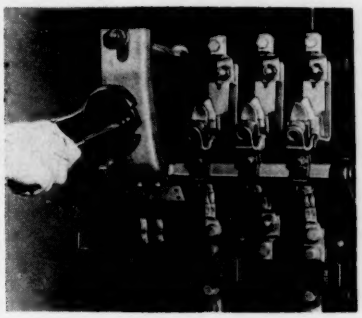
. . . More



When cleaning the magnet assembly with a solvent, don't let the coils become soaked. Care should also be taken to prevent breakage of auxiliary movable contacts when the magnet assembly is dropped open. Do not use toxic solvents such as CCl_4.



Check clamp on operating shaft to permit adjustment for contact over travel, proper contact alignment, pressure, and to compensate for contact wear. Use proper tools, also; in this case, an Allen wrench.



To insure perfect sealing and alignment of armature with the magnet, adjust screw as shown. Be sure armature closes simultaneously on top and bottom legs of "E" frame.

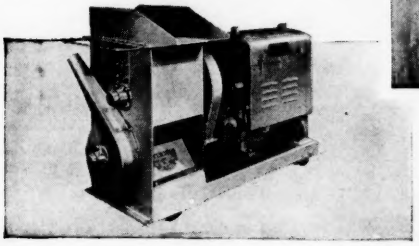
Here's how a LINK-BELT Ice Crusher-Slinger

opens new, larger markets for you

Top-icing is fast and effective

HERE'S extra profit for your ice service . . . helping shippers, wholesalers and warehousemen preserve perishables —in storage or en route. And a Link-Belt Ice Crusher-Slinger is your best means for getting your share.

These low-cost, efficient machines with capacities from 15 to 60 tons of crushed ice per hour . . . provide a slow-melting ice blanket that maintains correct temperature and moisture to keep perishables fresh. Link-Belt Ice Crusher-Slingers are available with gasoline engines or electric motors—in stationary or portable models. For facts, write for Book 2382 . . . or call your nearest Link-Belt office.



DAIRY PRODUCTS and other perishables remain cool and fresh in warehouse or en route to market under a uniform blanket of crushed ice.

LINK-BELT

ICE CRUSHER-SLINGERS

14.576

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

be checked by compressing with the fingers to determine whether one is weaker than the others. A good rule to follow, is to replace contact springs when replacing contacts.

New methods of impregnation have greatly reduced coil burn-outs. However, in the event of ac coil failure, the contactor should be checked for mechanical binding or blocking.

For example, an ac contactor coil may have a 47 ampere inrush value with the magnet open, and 1.7 amperes with the magnet closed in the sealed position. If the magnet is accidentally blocked open, or the voltage is so low that the magnet cannot seal against the contact springs, the current will be high, causing a burnout.

Check Stranded Leads Clean Arc Shields

Connectors made of fine stranded wire are subject to repeated flexing. Eventually some of the strands may break and the current increased on the remaining strands. In such instances the lead should be replaced.

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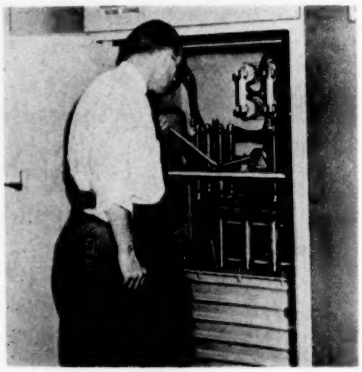
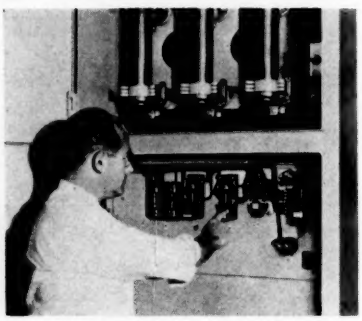
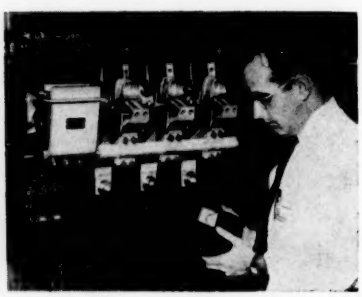


If water, sludging or excess carbon is present in high-voltage, oil-immersed contactors, new oil should be used. Check contact tips when inspecting oil for presence of carbon, etc.



Thermal overload relays should be reset or maintained only by experienced electrical men.



Proper installation and maintenance of control is vital to its ability to perform satisfactorily. Checking the line voltage is a wise precaution. Low voltage is apt to show up especially during starting.

CONTROL TROUBLE-SHOOTING CHART

SYMPTOM	POSSIBLE CAUSE	CURE
MANUALLY OPERATED CONTROLLERS		
Excessive Contact Burning	Low contact pressure, contacts not properly aligned	Adjustment by inspection. On drum controllers adjust star wheel lever spring to center the finger as it strikes the contact squarely.
Burning Out Resistors	Starting sequence stopped at mid-point	Instruct operator.
Failure to Pick Up	Low voltage on coil	Check system.
Failure to Hold In	Coil burned out, or wrong coil	Replace.
	Excessive magnet gap	Check gap.
Failure to Drop Out	Mechanical binding	Clean and adjust.
	Contact welded	See Contacts.
	Voltage not removed	Check circuit.
THERMAL OVERLOAD RELAYS		
Failure to Trip	Wrong size heater	Check instruction sheets.
	Mechanical binding	Clean and adjust.
	Relay damaged by short circuits	Replace relay.
	Motor and relay in different ambient temperatures	Install motor and control in uniform temperature.
Trips at too Low Current	Wrong heater	Check instruction sheets.
	Heater assembled incorrectly	Check instructions.
	Heater in high ambient	Install relay and controller near motor or in cooler place.
	Wrong calibration	Refer to factory.
Trips on Starting	Starting cycle of motor too long	Refer to factory.
Failure to Reset	Broken mechanism	Replace relay or broken part.
Burning of Relay Contacts	Short circuit	Check wiring of push-button in the circuit.
	High coil current	Check holding coil current
	Vibration	Remount control.
	Dirt and corrosion	Clean and adjust.
	Misapplication	Use interposing relay if handling too high coil currents for relay contacts.
CONTACTS		
Short Contact Life	Interrupting too high a current	Use special tips or next larger size contactor
	Using oil immersed device when air should be used (Note: Contacts burn many times faster in oil than in air.)	Use air break device if oil is not necessary or if oil is imperative, try heavier duty oil-immersed device.
	"Bounce" on opening or closing	Readjust contactor for "bounce."
	Abrasive dust	Dust tight enclosure
	Low contact pressure	New contacts and/or springs.
	Frequent jogging	Larger size contactor.
Contact Chatter or Pumping	Poor contact in control circuit	Check connections in control circuit.
	Fluttering control relay, such as pressure or temperature switch	Repair pilot device.
	Broken shading coil	Replace.
	Bad interlock	Increase wipe and pressure on sealing interlock.
Overheating	Copper oxide	Clean lightly with file.
	Heavy load for more than eight hours continuous operation	Use silver alloy tips.
	Overloaded	Reduce load or use larger control.
	Weak contact pressure	Clean and adjust. Replace contact spring and contact if wear allowance is used up.
	Poor connection	Tighten.
Weak Pressure	Worn tips	New tips.
	Poor adjustment	Readjust gap and wear allowance.
	Low voltage, magnet not sealing	Correct voltage, use lower voltage coil.
Welding of Contacts	Poor spring pressure	New springs.
	Abnormal currents	Less current, larger device or non-welding contact tips.
	Repeated jogging or inching	Controllers must be derated for jogging duty due to severe strain.
		Use next larger device or tell operator to jog more slowly. Special alloy tips may also help.
	Low Voltage—Contact may drop part way open on slow dips of voltage	Raise voltage.
	Bouncing of contactor	Eliminate overvoltage and/or mechanical difficulties.
COILS		
Open Circuit	Contacts not sealing	Eliminate mechanical binding of contactor.
	Failure to insert protective resistor on dc	Interlock not making contact—Repair interlock.
	Mechanical injury	Replace coil, use more care.
	Very rapid jogging	Check application.
	Short time rated coil energized too long	Check timing sequence.
	Overvoltage and/or high ambient	Check circuit and application.
Coil Failure	Moisture or corrosive atmosphere	Special coils.
SLIDING CONTACTS Used on rheostats, knife and drum switches		
Overheating	Overcurrent, weak contact pressure	Dress copper contacts or use special alloy contacts. Lubricate contacts periodically as recommended.
Excessive Burning	Rapid lever operation	Operate more slowly to eliminate starting arcs across the line which causes burning of contact surfaces and flashover.
Irregular Surfaces	Lack of maintenance	Smooth over contact surface and lubricate. Do not use emery cloth.
Abrasion	Lack of lubrication	Apply light coat of vaseline.
MAGNETS		
Noisy	Low Voltage	Raise voltage or use lower voltage coil.
	Broken shading coil	New shading coil or if face of magnet is worn down, install new magnet frame.
	Dirt	Clean sealing surface of the magnet and bearing points; lubricate with good grade of white machine oil.
	Misalignment	Realign.
Fail to Open	Grease on magnet surface	Clean.
	Misalignment	Realign.
	Contacts welded	(See contact welding).

by: H. A. WRIGHT
Supervisory Engineer
General Purpose Starters
Control Department
Allis-Chalmers Mfg. Co.

New leads should be formed by hand so they will take the flexing over the entire length rather than at one point.

Arc shields should be checked to make sure they are in place and not obstructed with dirt. If severely coated with carbon or copper deposits, they should be cleaned.

Inspect Oil-Immersed Breakers And Oil-Filled Components

Some controllers have dashpots which may be air or liquid filled. If oil-filled dashpots, only special dashpot oil should be used. The dashpots should be checked to make sure they are not sticking or binding.

The oil or high voltage oil-immersed contactors and circuit breakers should be maintained at the recommended level, and should be periodically inspected for water, sludging and excess carbon.

Some of the most frequent difficulties common to most electrical control devices are pinpointed in the *Control Trouble-Shooting Chart*. Also shown is a *Preventive Maintenance Check List* to serve as a guide in setting up a thorough maintenance program.

PREVENTIVE MAINTENANCE CHECK LIST

Date ..... Tool No. ..... Voltage .....

Serial No. ..... H p ..... Location .....

Pull disconnect switch before working on control

Check	Item	Operation
☐	**Dust**	Clean.
☐	**Rust and Corrosion**	Clean—Report if excessive.
☐	**Connections**	Tighten electrical connections, look for discoloration of any copper current carrying parts.
☐	**Nuts and Bolts**	Check mechanical connections.
☐	**Fuse clips**	Check for spring clip pressure.
☐	**Fuse ferrules**	If copper, polish; loose ferrules and proper size fuses.
☐	**Contact tips**	Look for copper oxide scale, dress only if necessary. Check roll and wipe.
☐	**Contact pressure**	Check contact pressure, is pressure same on all tips.
☐	**Flexible leads**	Look for frayed and broken strands, flexing over entire length.
☐	**Bearings**	Do not oil; are they free moving.
☐	**Coils**	Check for any signs of overheating or mechanical injury.
☐	**Magnets**	Clean faces, check shading coil, misalignment, mechanical binding, striking coil.
☐	**Overload relays**	Trip by hand, mechanically free, clean, check heater coil and tighten all connections.
☐	**Arc shields**	Check for breaks and burning.
☐	**Blowout coils**	Check for overheating and tighten.
☐	**Dash pots**	Free; clean, if oil type, check oil level.
☐	**Push Button or selector switch**	Clean, check contacts.
☐	**Relays**	Clean and check for mechanical binding and sticking. Check contacts.
☐	**Resistors**	Check for signs of overheating, if sliders tighten.
☐	**Oil Immersed Devices**	Drain small quantity from bottom to remove sludge, if much sludge, drain oil and clean. Check level and add; replace oil if black and dirty; check contactor and wipe off carbon.
☐	**Drum Controllers**	Tighten and check for contact wear and overheating; put small amount of vaseline on sliding surfaces.
☐	**Pilot Devices**	Clean and check contacts.
	START THE MOTOR OBSERVING ALL SAFETY PRECAUTIONS FOR DRIVEN MACHINES.	
☐	**Check starting sequence**	Does the control function properly.
☐	**Contactors**	Flash on closing, if so, check for adjustment to eliminate contact bounce.
☐	**Noise**	Check shading coils, magnet surface, sealing, mechanical binding, loose rivets.
☐	**Pilot Devices, Pressure Switches, Temp. Switches**	Check tightness and top limits of operation. Is there any fluttering of contacts donated by pumping of main contacts.

List any parts which will have to be replaced in the near future.

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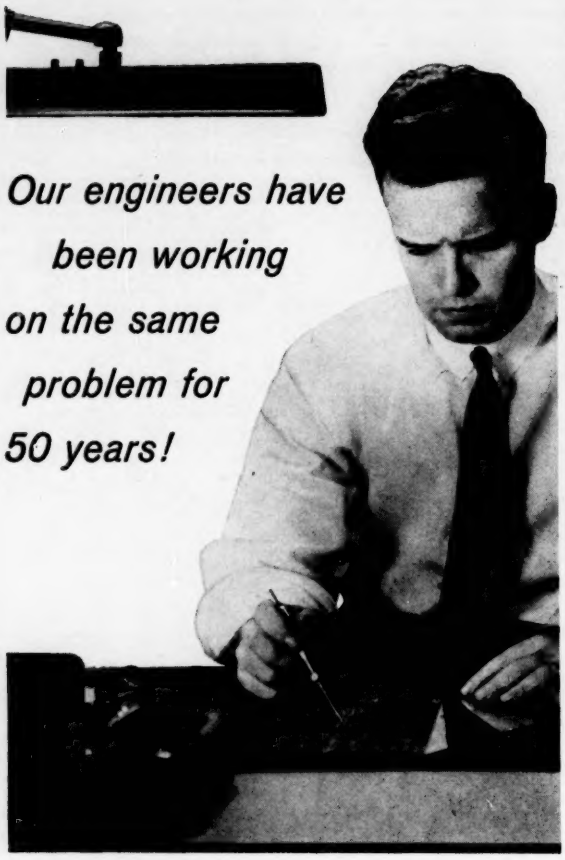

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Fresh Water From Sea Water

▶▶▶PROCESSES DEVELOPMENT DIVISION, U. S. Department of the Interior, is vitally interested in early results from a pilot plant designed to convert seawater to fresh water by a freezing method. Pictured here are Dr. J. F. Downie Smith, left, Carrier Corp., and J. J. Strobel, chief, USDI Office of Saline Water. The occasion was an inspection of the 15,000 gpd pilot plant under construction at Syracuse, N.Y.

The pilot plant will use a direct freezing process described by C. M. Ashley, chief staff engineer, Carrier, and C. M. Bosworth, USDI, at a Saline Water Conversion Symposium in the District of Columbia in November 1958. Economic evaluation of the process is a primary object of the pilot plant contract. (See INDUSTRIAL REFRIGERATION, Feb. 1958, page 23; INDUSTRIAL REFRIGERATION, Feb. 1959, page 5).

Icebergs Furnish Fresh Water

▶▶HUME NEWS, May 1959, a Melbourne, Australia publication, published an extract suggesting the Antarctic icebergs would be a good source of fresh water. In lieu of a by-line the editor inserted a statement in parenthesis, "We take this with a grain of salt".

Scientists down under estimate 10,000 million tons of fresh water could be obtained from melting down one big iceberg. A special floating fence 12 feet deep to surround the floating monster during the melting process would be required, and the six ocean going tugs to bring it in, would come to about $1,793,200. Even so, the editor comments, that would give the nation very cheap water.

Refrigeration For Nuclear Ship

▶▶ LAUNCHED on July 21 by Mrs. Dwight D. Eisenhower was the Nuclear Ship Savannah, the first merchant vessel to be powered in this manner. Refrigeration for the vessel includes three plants, one each for air conditioning, refrigerated cargo holds, and the ship's stores.

Accommodations for 60 passengers and 130 crewmen, plus the operating areas such as that adjacent to the reactor and the turbines, will be air conditioned by a Carrier marine centrifugal unit of 210-TR. The Savannah's below deck operating areas will be open to passenger visits in contrast with the "off-limits" traditionally given to these areas in conventional vessels.

NAPRE Educational Committee Shapes Up Fall Program

Roy T. Burns

R. E. Zach

H. P. Hayes

G. R. King

Frank L. Chase

▶▶RICHARD E. ZACH, Refrigeration Instructor, University of Wisconsin, is the educational program chairman for the 49th Annual Meeting of the National Association of Practical Refrigerating Engineers. That meeting will be held at the Roosevelt Hotel, New Orleans, December 9, 10 and 11, 1959. Zach was appointed by President Roy T. Burns, to the chairmanship left vacant earlier in the year by the acceptance of Dean W. F. Woolrich of an appointment as President Consultant at the Mid-East University, Ankara, Turkey.

Ten Features Planned

After consulting with educational director Frank L. Chase, and the Association's educational chairman and vice-chairman, Dean Harold P. Hayes, California State Polytechnic College, and Professor Guy R. King, Santa Monica City College, Zach recently published from the NAPRE headquarters in Chicago, a general outline of the national meeting educational highlights. Ten specific presentations will be made and one major field trip has been scheduled. A number of short presentations will be made by Industrial Members of the Association in addition to the educational program, exhibiting latest equipment.

One paper already prepared, is an analysis of a typical lithium bromide cycle for an absorption refrigeration system. This paper will be presented by the educational program chairman, Zach. He will show the practical engineers a collection of the necessary data for determining the heat transfer co-efficients which are used by the manufacturers in designing these systems.

Popular Topic

Applicable to water chilling systems for either central station air conditioning or industrial processes, these units have received wide publicity recently. In addition to highlighting those design considerations of which the practical engineer should have an understanding, Zach will deal also, briefly, with the economics of the systems as compared with conventional compression refrigeration. Operation and maintenance will also be touched on by the speaker.

Licensed as a professional engineer by the State of Wisconsin, Zach instructs classes in thermodynamics and refrigeration at the University. At the same time he is working on advanced degrees in heat transfer. He is a graduate of the University, 1952. From 1952 to 1957 he was employed by York Div., Borg-Warner Corp. in the Chicago Central District office. He served as one of the instructors for Chicago Chapter, NAPRE, at that time.

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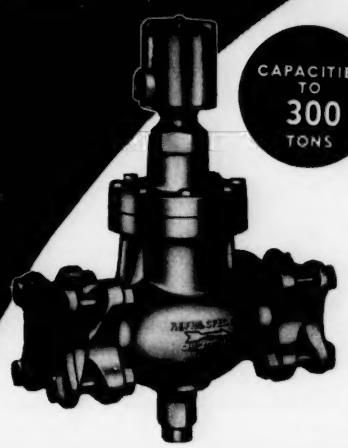

AVAILABLE CONNECTIONS ODS	FPT	Welding	Port Size	Tons, R-12 Liquid	Tons, R-12 Suction	Ammonia Suction
7/8, 1 1/8, 1 3/8	3/4, 1/2	3/4, 1/2	3/4	32	5.1	11
1 1/8, 1 3/8, 1 5/8	1	1	1	40	7.0	14
1 3/8, 1 5/8, 2 1/8	1 1/4	1 1/4	1 1/4	60	10	23
1 5/8, 2 1/8, 2 5/8	1 1/2, 2	1 1/2, 2	1 5/8	100	15	35
2 1/8, 2 5/8	2	2	2	140	23	58
2 5/8, 3 1/8	2 1/2	2 1/2	2 1/2	220	27	85
3 1/8, 3 5/8	3, 2 1/2	3	3	300	60	130
4 1/8	4	4	4	.....	90	220
5 1/8	5	5	5	.....	150	370

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NAPRE QUESTION BOX

HAVE A QUESTION? Address it to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif. Answers appear monthly in this department on problems forwarded by NAPRE members. Comments from all readers welcomed.

H. P. Hayes

Brushless Generators Use Silicon Diodes For AC-DC Field Excitation Conversion

QUESTION: Recent literature in power and railroading magazines deseribes a c generators as being brushless. Is this a new development in the small generator field (6.25 to 187 Kva)? —F.L.B., St. Louis

ANSWER No. 1: Principle difference in construction of these "so-called" brushless generators as used in our refrigerator cars, is that the exciter armature producing the exciting current for the generator field, feeds a rotating rectifier assembly where the alternating current is converted to direct current and connected directly to the generator field.

This construction is illustrated in the three figures.

Electric Machinery Mfg. Company is one of the suppliers of this type of equipment for our use. This has proved to be a very rugged and dependable piece of equipment, and elimination of the brushes and slip rings has reduced our generator maintenance practically to zero with respect to the electrical end of the units.

—E.F. Gaebler, Ch. Engr.
Pacific Fruit Express Co.

ANSWER No. 2: As Mr. Gaebler pointed out, a brushless generator is a generator which has neither a commutator nor slip rings and likewise no commutator or slip ring brushes. Like many technical achievements, the theory preceded the hardware by many years. The necessary hardware, in this case, was the development of the high power silicon diode.

With the silicon diode, an a-c to d-c (rectification) conversion can be made with a very small device that can be incorporated in the rotor of the generator. This is also a very tough and efficient device, and very importantly, the silicon diode has become attractive in price, competing directly with d-c exciters.

Silicon Diode Advantages

These silicon diodes, or silicon rectifiers as they are commonly called, have some important advantages: they are up to 99% efficient in achieving rectification, their size is very small, they do not lose efficiency with age, and they operate indefinitely at high temperatures thereby offering high reliability.

Operation Explained

To show how a brushless generator works, it is helpful to compare it with a conventional generator. A conventional generator uses a rotating exciter furnishing d-c to the generator field through two sets of brushes. One set is on the exciter commutator, the other set is on the generator rotor slip rings.

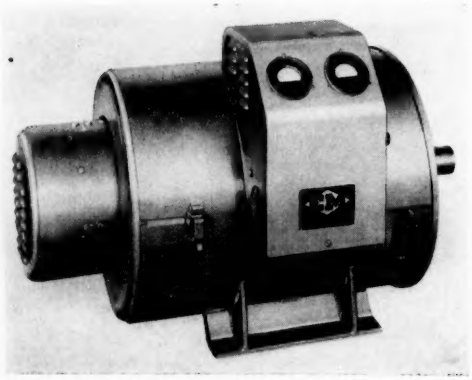
A conventional exciter is basically an a-c generator, the output of which is rectified through a commutator. Fundamentally, brushless generators replace the commutator with another type of rectifier, the silicon diode or silicon rectifier.

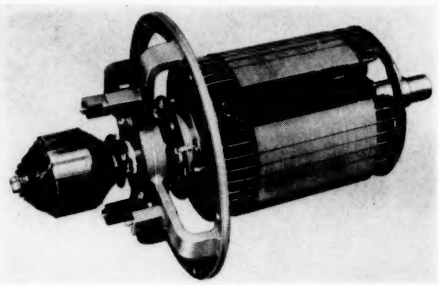
Three-Phase Excitation

Usually six rectifiers will be used in a brushless generator. They are the six (three each) bolted components lined up with the (three) openings in each of the circular plates pictured. The assembly is mounted on a collar attached to the generator shaft. The rectifier assembly rotates with the rotor.

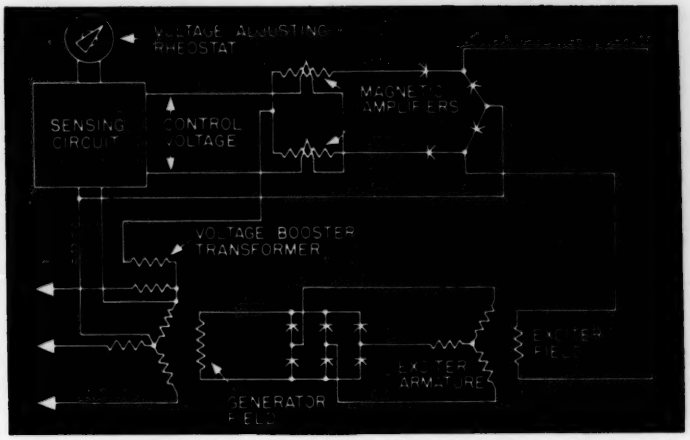
The exciter for the brushless generator is a three phase exciter, which gives high efficiency and output. This a-c exciter receives its field or magnetism in two ways. In part, the build up is caused by the residual

Typical "Brushless" Generators Used In Mechanical Reefer Cars





Center, a close-up view of the rotating silicon diode rectifier assembly showing the six diodes in this unit.
Right, the complete rotor assembly of the brushless generator. A-c exciter armature is at left, the rotating rectifier assembly is shown through the spider opening of the bearing frame, and windings at right are the generator field.
Left, an assembled view of the brushless generator showing voltage regulator housing, meters and enclosure.



Schematic diagram shows general hook-up or arrangement of the silicon rectifiers, magnetic amplifier voltage regulator and fields.

magnetism of the exciter. Primarily, however, the build up stems from a simple rectifier circuit, which takes part of the generator output, rectifies it, and furnishes a field for the exciter. See the Schematic Drawing.

The brushless line is offered in packaged units complete with voltage regulator and meters. A magnetic amplifier type voltage regulator is used.

–S.P.B., Electric Machinery, Minneapolis

SUMMERTIME OPERATIONS often bring out the worst of the refrigerating system. What operating experience proved a headache in your plant? Can the QUESTION BOX put you on the trail of a correct solution?

What Is A "Mol"?

QUESTION: What is a "mol"? In the article by David H. Wood on Fertilizer Grade vs. Refrigeration Grade NH_3, INDUSTRIAL REFRIGERATION, May 1959, there is a reference to "liberation of 13000 calories per gram mol". Would you compare calories with Btu's for me?

–R.L.F., Chicago

ANSWER: Mr. Wood's statement: "In this reaction (the synthesis of ammonia), there is a liberation of 13,000 calories per gram mol" means that 13,000 calories are given off as 17 grams of NH_3 are synthesized.

The molecular weight of NH_3 is seventeen grams. A *gram* mole equals the molecular weight of a compound in grams. A *pound* mole equals the molecular weight of a compound in pounds. For example, a mole of NH_3 weighs either seventeen grams or pounds depending on which mole you are talking about.

In answer to your second question, one Btu is equivalent to 252 calories. One thousand calories or one kilogram-calorie (the big Calorie you read about in diets) is equivalent to 3.968 Btu's or four Btu's.

–R.G.R., Cal Poly.

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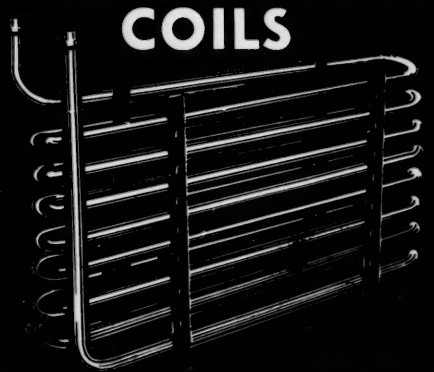

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As Los Angeles Hosted So'West NAPRE Conference

"Bureau of Refrigeration Information" panelists (left to right) are Robert McKee, Ed. L. Nelson, Chapter President Guy R. King, Mortimer E. Bell, Regis Gubser.

General view of the audience at the Southwest Pacific Coast Regional Conference, NAPRE, May 1 and 2, in which some 80 visiting members from seven western chapters participated.

▶▶DIVERSIFIED refrigeration subjects were presented at the Southwest Pacific Coast Regional Conference, NAPRE, held May 1 and 2 at the Mayfair Hotel, Los Angeles, under the sponsorship of Los Angeles Chapter. Success of the conference elicited recommendations from local and visiting delegates that the Conference be made an annual affair. This hearty approval accorded the 1959 program is expected to be a determining factor in influencing officers of Los Angeles and other California chapters in competing for sponsorship of another conference in Spring, 1960.

Five educational sessions averaged 80 persons, and approximately 200 members, guests and ladies were present for the dinner dance which closed the event.

Delegates were present from Los Angeles, San Francisco, Colton, Bakersfield, Fresno and Modesto-Stockton chapters. Unattached refrigeration engineers from such widely separated points as San Diego, San Luis Obispo, Santa Clara and Roseville, Calif., and Ogden, Utah, plus an engineer from Helsinki, Finland, also registered.

The Los Angeles Chapter committee which handled the arrangements consisted of president Guy R. King, first vice-president Larry Benedict, second vice-president N. P. DeSantis, treasurer E. T. Quinn, secretary Donald H. Byl, and past-presidents, Regis Gubser, George Paulick and Michael Julius. Ladies activities were arranged for and directed by Mesdames King (chairman), Benedict and DeSantis. Visits to Art Linkletter's TV House Party Program, the Farmer's Market and various other Los Angeles points of interest were on the program for the ladies.

The suggestion that the regional conference be developed into an annual institution came first from Robert McKee, Ass't Chief Engineer of Pacific Fruit Express Co., San Francisco, who assisted Los Angeles Chapter's committee materially in speaker arrangements.

Technical Program

First speaker was Peter J. McCarty, Sporlan Valve Co. His subject was "Trouble Shooting Refrigeration Controls", and was a commentary for a series of slides which illustrated various installations of low pressure thermostatic ex-expansion valves.

Well received was a talk on "Centrifugal Pumps and Piping" presented by Cy Otterholm, Richard S. Dawson Co., Los Angeles. Otterholm had reproduced his talk and copies are available. It will also appear in an early Fall issue of INDUSTRIAL REFRIGERATION. While the centrifugal pump is but one of many on the market, it represents 85 percent of the pumps manufactured in the U S. each year. He briefly explained the mechanism and operation of the centrifugal pump. One advantage cited was the fact that they have no sliding or rubbing

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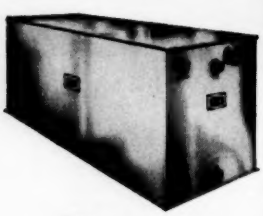

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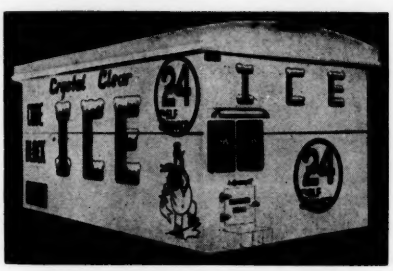

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By FRED HERR
Los Angeles Correspondent

parts, and are ideal for most any water application as they can handle fluids containing abrasives.

Roses, Potatoes and Hay

Harold Halls, Recold Corp., Los Angeles, talking on "Unusual Refrigeration Applications" said that by storing new rose buds in a temperature under 28F, they can be made into corsages that will stay fresh about two hours before beginning to wilt. On potatoes, he said that recent attempts to reduce sprouts of potatoes through refrigeration have met with some good and some negligible results. Halls explained how refrigeration is playing an important role in the production of dehydrated alfalfa meal, an animal feed, on a 6000-acre ranch near Firebaugh, Calif.

King Demonstrates Typical Program

Guy R. King, Los Angeles Chapter president and Vice Chairman, National Educational Committee, NAPRE, conducted a one-hour "Demonstration NAPRE Class". The program was presented to give delegates from other chapters an idea of how leading NAPRE chapters conduct their educational programs. Following that a period was devoted to a panel discussion which was listed as "The Bureau of Refrigeration Information". With moderator R. Gubser were Guy R. King, Santa Monica (City College, instructor of refrigeration); Robert McKee, PFE, San Francisco; Ed. L. Nelson, Union Ice Co., Los Angeles, and Mortimer E. Bell, Associated Refrigerating Engineers, Los Angeles, an NAPRE National Vice President. The program was in the form of a series of selected questions on refrigeration problems presented by Gubser, to which the audience was requested to supply the answers. When audience participation wasn't forthcoming, or a point was missed, the "Bureaucrats" elucidated.

Construction, Cryogenic Topics

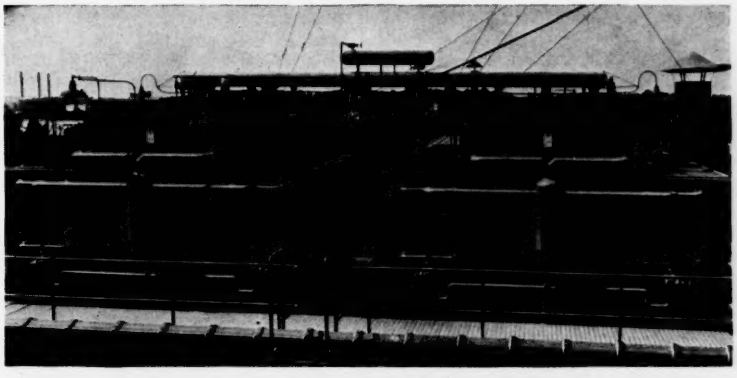
On May 2, Ed L. Nelson and George Paulick collaborated on a presentation entitled "New Cold Storage Construction and Refrigeration Methods". Paulick first took the floor to describe the construction of a new Los Angeles cold storage. Nelson's task was to describe refrigeration and cooling equipment which had been installed after the building construction was completed.

Talks were also presented by the following: Joseph Horacek, Jr., Collier Carbon & Chemical Co., Los Angeles, on "Liquid and Dry CO_2, New Developments in Production and Usage"; C. R. Kohlenberger, Kohlenberger Engineering Co., Fullerton, Calif., on "Design of Modern Poultry Processing Plants"; Robert McKee, Pacific Fruit Express, San Francisco, on "Mechanical Car Refrigeration"; and Louis E. Smith, Phillips Refrigeration Products, Inc., San Francisco, on "Controlled Atmosphere for Unusual Preservation of Fresh Apples".

Tennessee NAPRE Officer Receives Hero Award

MEMPHIS—Sixteen months ago Emerson S. Boland, although critically burned, stayed at his post and performed his duties as engineer in the Ellis Auditorium, following a gas explosion. His devotion is credited with having saved many lives and prevented panic among those in the capacity packed auditorium. Firemen, responding to Boland's call, rescued him.

Pictured here is President J. Lester Skinner of the William R. Moore School of Technology, presenting a plaque to Boland (right) on June 16 at a Rotary Club meeting in the Peabody Hotel. Skinner, chairman of the Rotary Awards Committee, stated that Boland's was an unusual act of heroism, making his own painful burns secondary to having the auditorium evacuated and notifying the fire department. Boland who is 2nd vice-president of Tennessee Chapter No. 1, NAPRE, shared the platform honors with B. S. Gilmer, President of Southern Bell Telephone, Atlanta, Georgia. Gilmer was the featured speaker but stated he considered it a high honor to appear on the same program with Boland, whose wife and two young daughters were present for the ceremony.—*Chas. A. Conley.*



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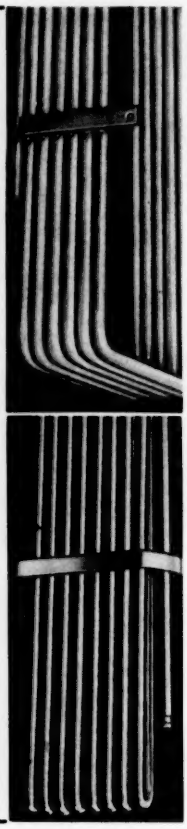

REFRIGERATION NOTE BOOK

by PAUL B. REED

THIS NOTE BOOK of condensed refrigeration information represents many years of work in accumulating practical data—"culling out" all extraneous material—so as the author states, the reader will find a handy and easily carried source of information not usually kept in memory."

You will be surprised at the wealth of material that has been included in this convenient and practical reference Note Book. It is written in layman's language, without complicated formulas. In short, it is a tool responsible for the operation of refrigeration equipment.

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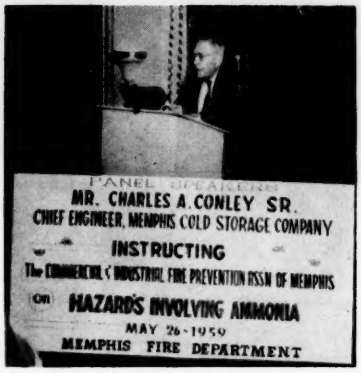
Hazard's Involving Ammonia



▶▶ENGINEERS who operate larger refrigerated plants live and work with ammonia days in and out. They recognize the hazards of ammonia but do not consider it as hazardous as most people, *because they know how to work with it safely.*

Ammonia that these engineers use is known to them as *anhydrous ammonia.* In cold storages, ice cream plants, packing houses, breweries and many other types of industrial refrigerating plants, anhydrous ammonia is used in tons.

Operating engineers know that ammonia is hazardous *under certain conditions.* Under somewhat similar conditions many chemicals become hazardous, because a change of the product has taken place and it is no longer pure.

Built-in Alarm

Pure anhydrous ammonia is colorless, tasteless, will not burn or explode. It is very toxic, suffocating and irritating. One good thing about ammonia is its very pungent odor. Whenever it is smelled it gives a warning. When engineers smell ammonia in their plants they get busy to find where it is coming from and what has caused the smell; and correct the trouble.

When there is a bad leak of ammonia in industrial refrigeration plants, operators know what to do to stop the leak and protect themselves from hazards.

Operating engineers are in sympathy with firemen when they get an alarm from a refrigerated plant. Because firemen are not fully acquainted with the layout of the various plants, when they go into a plant where something has caused a very bad ammonia leak they can be rendered helpless from the toxic and asphixiating qualities of ammonia. Most refrigerating plants, especially the old multiple story installations, do not have too many openings in the refrigerated area such as doors and windows, which would let in the atmosphere.

Ignition Limits

When anhydrous ammonia is released from a system, into the open spaces, it is no longer pure ammonia. It is anything else than pure ammonia. Ammonia when mixed more than 16 or less than 27 percent by volume with air will ignite and burn. Rapid ignition would be explosive. *Ammonia under these conditions is dangerous.*

An industrial refrigeration plant should be in charge of a licensed, competent engineer at all times. Engineers who operate refrigerated plants have two housekeeping jobs to do.

A competent engineer will keep his plant in a clean orderly way so as to *prevent fires.* He should *keep the refrigeration system free of all foreign matter,* such as air, water and oil; keep his plant purged at all times so as to prevent the ammonia in the system becoming contaminated or cause the refrigerant to become anything else than pure ammonia. A well managed and kept plant will not have leaks in the system other than an occasional trace at machinery glands or stuffing boxes. An engineer who cares about these two items will as a rule also be an efficient operator as well.

Breathing Apparatus

All refrigerated plants should have several approved gas masks strategically placed at several entrances into the plant. The masks should be kept in a clean accessible location. Masks should be inspected every three months. Good fresh canisters should be kept on hand. An air mask should be kept with the plant emergency gear and away from places which would be inaccessible in emergencies.

First aid kits and refill materials should be kept in the plants. This material should be kept fresh at all times, and only such materials as recommended by a physician should be used for ammonia burns and irritations.

First aid instructions or charts should be with each gas mask and they should be kept where the engineers and other employees can read them.

The engineer in charge of a plant should teach his assistants first aid measures, and how to use the masks.

Preventive Maintenance

Periodic examinations and inspections of refrigeration equipment should be made so as to avoid breakdowns. Pipe lines and vessels should be inspected to avoid various forms of corrosion and ascertain physical damage probabilities to pipe lines. Preventive maintenance as simple as periodic cleaning and exterior painting stops most corrosion of pipe lines, receivers and all vessels. All safety valves are always to be in good working order.

A talk given by Chas. A. Conley, Sr., Chief Engineer, Memphis Cold Storage Warehouse Company and Mid-South Refrigerated Warehouse Company, to The Commercial and Industrial Fire Prevention Association of Memphis, Tennessee, May 26, 1959. Conley based his talk on 52 years of experience operating the plant of the Memphis Cold Storage Warehouse Company. He is a past national president, NAPRE, and secretary, Tenn. Chapter.

Mfg'r's News (Cont'd)

More On Block Ice

▶WHILE INDUSTRIAL REFRIGERATION was announcing last month the purchase of Swiss patents by Pappas Industries, Inc., Houston, Texas, the NEW YORK JOURNAL OF COMMERCE carried an article on another European machine for manufacturing block ice without the use of brine, ice cells, agitator or filling device. Grasso's Koninklijke Machinefabrieken N.V. of Den Bosch, Holland has perfected a system which freezes water contained in a tank which is provided with a number of vertical double-walled pipes closed at the top.

Capacity is reported at 330-lbs of ice per three hours. No mention was made in the account as to how the blocks of ice were freed from the tank walls, or removed for storage.

▶JULY issue of ICE NEWS, published by the National Ice Association, announced that Harris Ice Machine Works in Portland, Oregon had produced a new ice making machine which makes block ice in 25, 50 or 100-lb sizes. This device is reported as capable of harvesting ice every eight hours. Several grades of ice can be produced and the machine has its own self-contained unit operating from ammonia or other refrigerants.

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FOR SALE—17"x17" one cylinder Vilter HDA ammonia compressor with direct connected 300 h.p. synchronous motor. Send inquiries to Chief Engineer, Pacific Fruit Express Co., 116 New Montgomery St., San Francisco 5, Calif.

FOR SALE—Worthington ice equipment for rink 85x200 ft. including 2 vessels and 2-8x8 compressors. A-1 shape; completely overhauled. For information write Phil Simon, Grand Rapids Stadium Inc., 1148 S. Division, Grand Rapids 7, Mich., or call CHerry 5-1171 or GLendale 1-1746.

FOR SALE—Frick 7x7 V-belt ammonia compressor 50 h.p. motor, cooling coils and float control, 2000 gallon capacity open top steel tank, shell and tube condensers and receiver. Available approximately September 1, in Eastern Ohio. Write Mack Machine Co., 3151 Emerald St., Philadelphia 34, Penna.

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9x9 York duplex unit, 200 h.p., 360 r.p.m.
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WANTED—Plant manager, by large ice company in Southern California. Must have knowledge refrigeration and be energetic to get ahead. Give experience, age, reference in first letter. Address Box AU-4, c/o Industrial Refrigeration.

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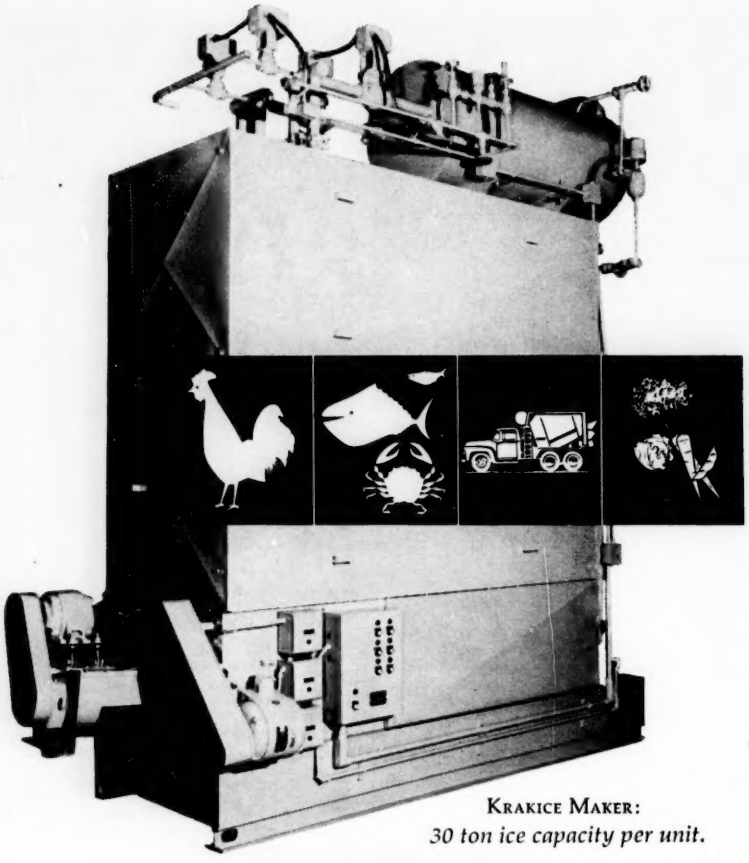

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Allied Chemical Corp., Nitrogen Div. 2

Barada & Page, Inc. .....Inside Back Cover
Brown Mfg. Co., Inc., K. G. 36
Butcher Boy Refrigerator Door Co. 1

Chicago Nipple Mfg. Co. 38
Classified Advertising 39

Dole Refrigerating Co. 36

Greene Associates, Van R. H. 39

IMECO, Inc. 26

Jamison Cold Storage Door Co. ..Back Cover
Johns-Manville Corp. .....20 and 21

King Co. of Owatonna, The 32
King Zeero Co., The 27
Kohlenberger Engineering Corp. 40

Link-Belt Co. 29

National Pipe Bending Co. 35
Niagara Blower Co. 37
Nickerson & Collins Co. 38

Phillips & Co., H. A. 31

Recold Corp. 5
Rempe Co. 39
Refrigerating Specialties Co. 33

Shank Co., Cyrus 35
Sporlan Valve Co. .....Inside Front Cover

Wanted and For Sale Advertising 39
Watkins Co., J. E. 25

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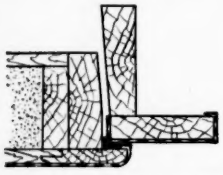

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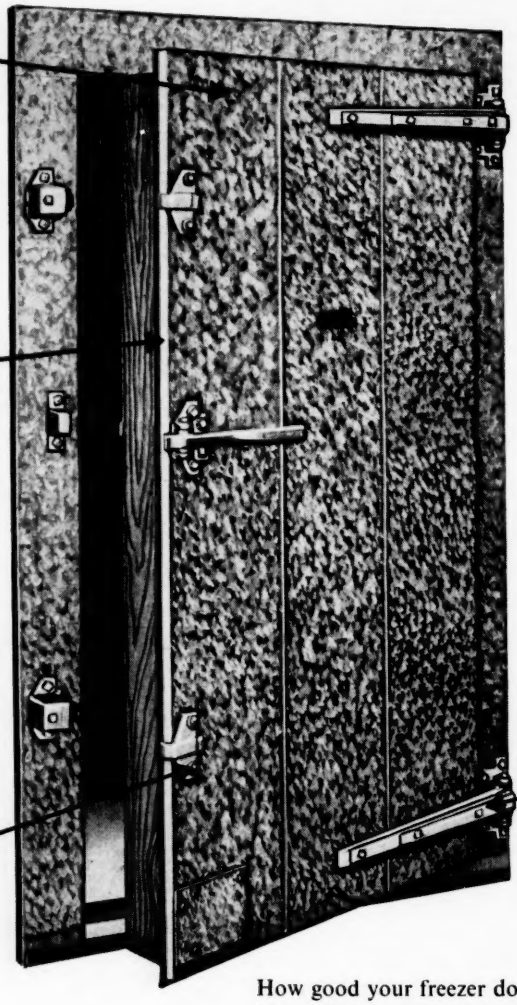

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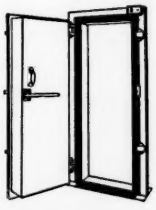

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